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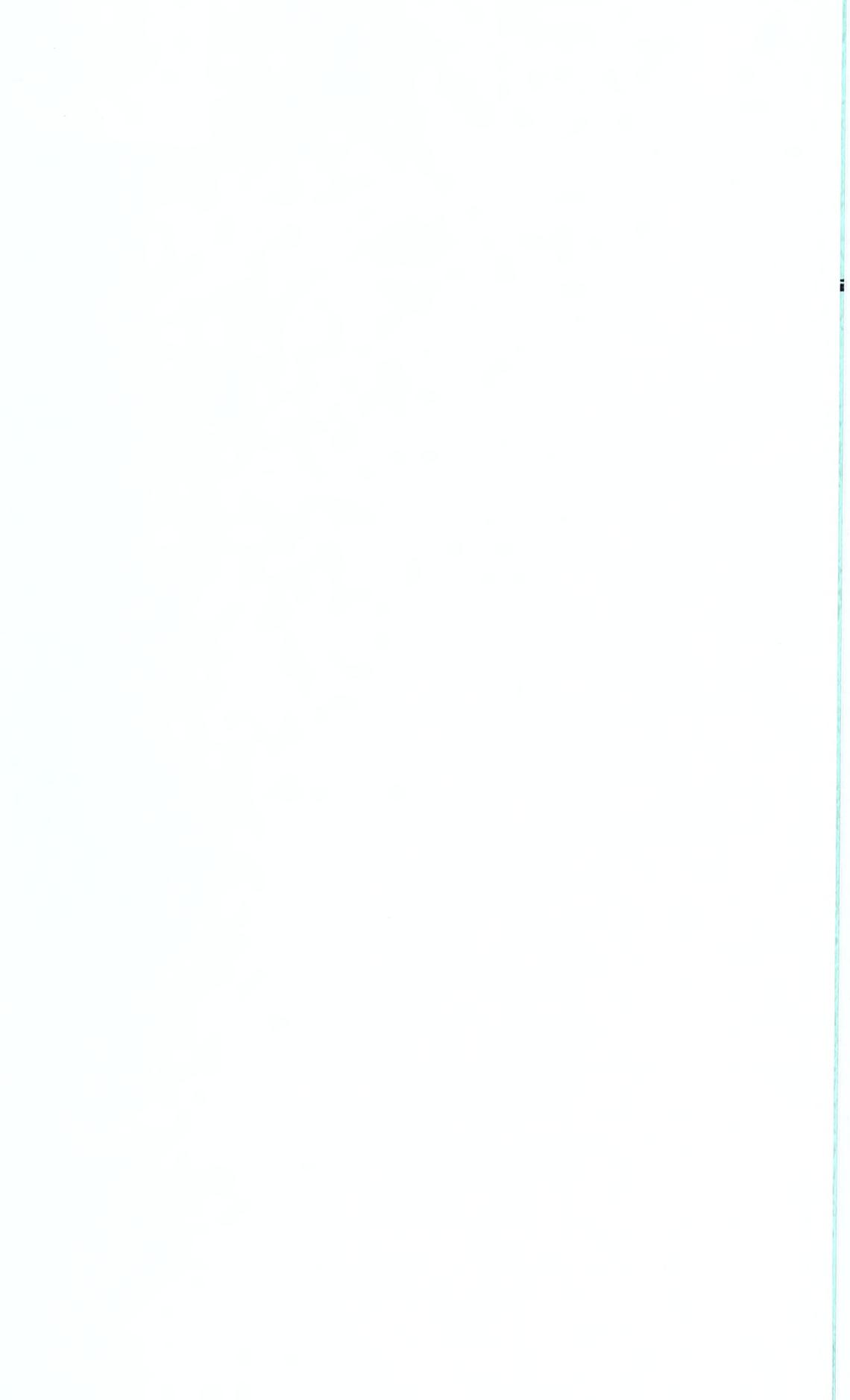
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Petrography of Coal in the Houtzdale Quadrangle, Clearfield County, Pennsylvania

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**Petrography of Coal
in the Houtzdale Quadrangle,
Clearfield County, Pennsylvania**

by Edwin F. Koppe

Coal Petrologist
Pennsylvania Geological Survey

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P R E F A C E

This report is the result of a study on the physical nature of coals in the Houtzdale 15-minute quadrangle, Clearfield County, Pennsylvania. The descriptions of the coals are mainly based on detailed examination of the various coals under the microscope. The report also contains previously published chemical analyses of the coals.

A brief description of each coal is presented with tables listing the microscopic components of the coals. This data, plus the individual descriptions of coal beds in the Appendix, will give the coal users and producers a clear picture of the physical nature of the coal beds in the area. The tables and detailed descriptions can assist coal users in selecting coals of particular types for their respective needs.

The detailed microscopic analyses of the coals, together with ash analyses of layers within the coal beds, show that the Houtzdale coals differ greatly from one coal bed to another as well as from top to bottom in the same bed. The analyses also show that the characteristics of a coal bed may vary from place to place within the same district. Coal operators and geologists will find that these differences help to identify and trace coals from place to place; this is of particular help where only coal samples are available from exploratory drilling. Knowledge of these physical changes may help operators in improving their product through selective mining or appropriate processing methods. The study also demonstrates that microscopic study of coal (coal petrography) is useful in correlating coals in a geologically complicated area.

It is hoped that this publication will stimulate the use and development of central Pennsylvania coals for a wider range of industrial applications.

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PETROGRAPHY OF COAL

IN THE HOUTZDALE QUADRANGLE,

CLEARFIELD COUNTY, PENNSYLVANIA

By
Edwin F. Koppe

ABSTRACT

Medium and low volatile bituminous coals of the Houtzdale quadrangle were studied through quantitative microscopic petrography and supplementary ash analyses to determine: 1) the maceral composition of the beds involved, 2) the lateral continuity of composition, and 3) the usefulness of this type of analysis for detailed geological correlations. Data are presented for 9 coals collected from 92 sample sites. Each coal was sampled by layers and the composition determined by reflected light microscopy of prepared crushed coal pellets. Bed totals, given for each coal, were obtained by calculations based upon the percentage of macerals in each layer as well as the percent contribution of the layer to the total coal.

Conemaugh coals (Mahoning, Upper Freeport rider) and Pottsville coal (Mercer) yield relatively low vitrinoid values and high ash concentrations suggestive of marginally economic deposits. Most of the economic Allegheny coals have high vitrinoid concentrations.

Petrography proved useful in establishing the identity of some coals over distances exceeding 4 miles. The Upper Freeport coal and some beds of the Lower Kittanning coal complex were readily identified by total coal composition. Other coal beds were more variable in composition and thus less identifiable and could only be correlated by means of individual layers within the beds.

INTRODUCTION

This report is written in an effort to help coal producers and consumers in further understanding the physical properties of medium- and low-volatile coals of Pennsylvania. Primarily, data are presented to elucidate the petrographic characteristics of coals in the Houtzdale 15-minute quadrangle. In addition, special emphasis is placed upon establishing coal petrography as a practical tool for identifying and correlating coals in problem areas.

The Houtzdale quadrangle lies west of the center of Pennsylvania mostly in southeastern Clearfield County, but partly in Centre County, as shown in Figure 1. It has an area of 225.9 square miles and is bounded by parallels North $40^{\circ} 45'$ and $41^{\circ} 00'$ and by meridians West $78^{\circ} 15'$ and $78^{\circ} 30'$. The quadrangle is divided into four named $7\frac{1}{2}$ -minute

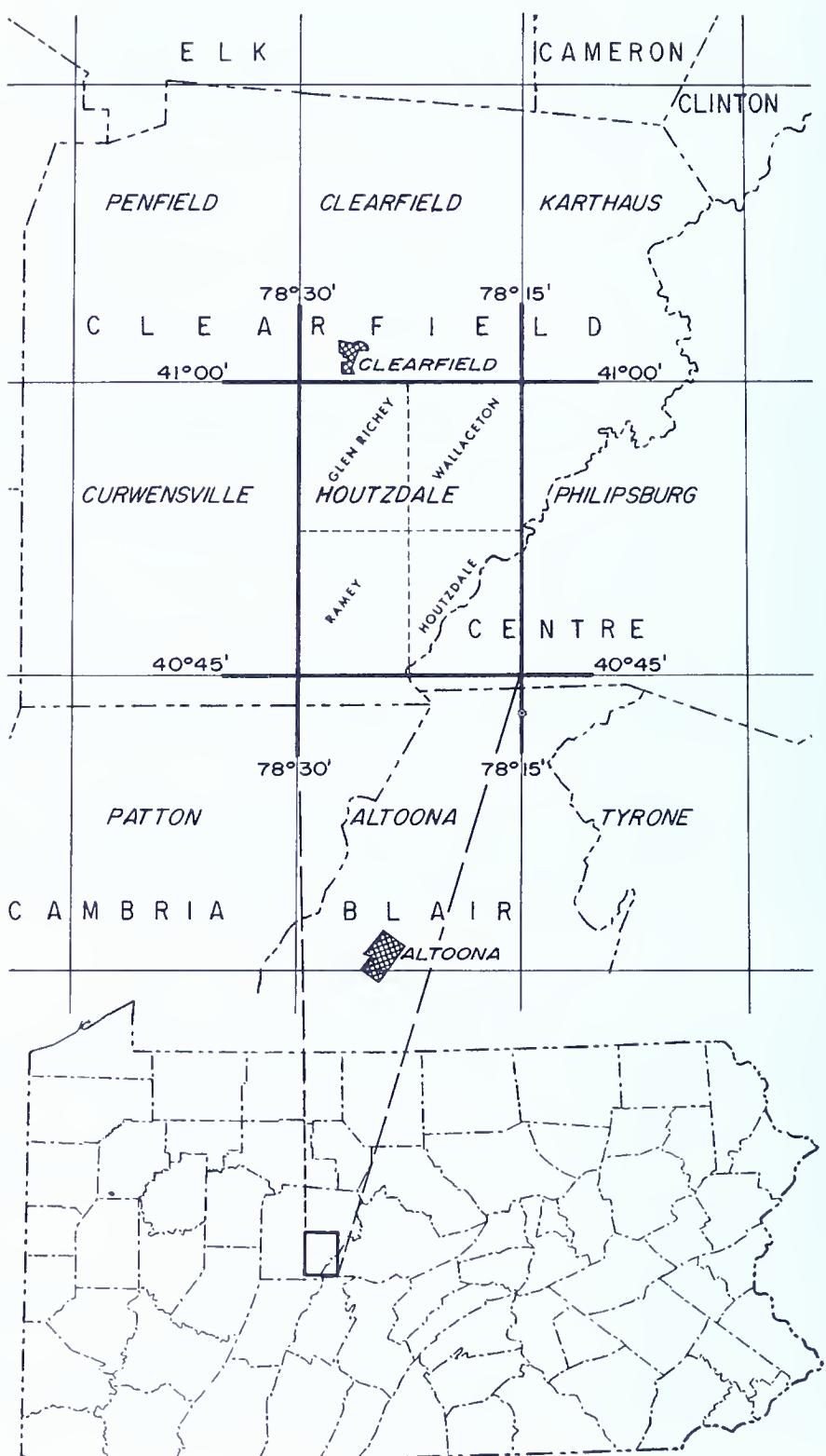


Figure 1. Location of the Houtzdale quadrangle.

quadrangles as follows: NW—Glen Richey, NE—Wallacetown, SW—Ramey, SE—Houtzdale. A large percentage of the quadrangle is underlain with valuable coals and clays. For nearly a hundred years, the coal resources have been developed by extensive underground mining and, more recently, by strip mining and auger recovery.

Geologically, the area is complex, both in sedimentary details and in structural modifications. The coal-bearing rocks are Pennsylvanian in age, as are all of the important coal strata of the Commonwealth. Virtually all of the mineable coals of the Houtzdale quadrangle are in the Allegheny Group. The Monongahela Group, which contains the important Pittsburgh coal; and the upper part of the barren Conemaugh Group are missing in this region because of erosion of the upper part of the geological section.

Although the area is not intensely folded, faulting in the eastern half of the quadrangle tends to confuse some correlations and horizontally displaces similar lithologic facies of the coal.

A thorough investigation of the geology of the Houtzdale quadrangle has been completed recently by V. C. Shepps and W. E. Edmunds. The geology of the northern and southern halves are being prepared as separate reports. For this reason only necessary stratigraphic geological information is presented in this paper.

Coal produced from the quadrangle is suitable for electrical power generation as well as for general industrial and domestic uses. It has also been used as a smithing coal and as a coking coal. A high percentage of present production is for utilization as a steam coal for electrical power generation.

Tables of published chemical analyses are included as aids for producers and users of the coal from this area.

ACKNOWLEDGEMENTS

The writer is grateful to many coal operators who provided access to the sample sites and furnished much needed information about the coal where no longer exposed. Special credit is given to Robert Sponseller, Pennsylvania Geological Survey Staff Geologist, who assisted the writer in the collection of samples, prepared all of the samples for microscopy, and assisted in accumulating published analyses of the coal.

METHODS AND PETROGRAPHIC NOMENCLATURE

Coals were collected for study from beds exposed in active and inactive strip mines, underground mines, and new road cuts. Each sample was located upon the appropriate $7\frac{1}{2}$ -minute topographic map and is recorded in this report to the nearest 100 feet from a 5-minute latitude

and longitude co-ordinate. For example, coal sample 85-C-23 was collected in a strip mine at a point 10,500 feet South of $41^{\circ} 00'$ and 7,500 feet West of $78^{\circ} 25'$ in the Glen Richey $7\frac{1}{2}$ -minute quadrangle. Where known, the name of the strip mine operator is recorded; however, no concerted effort was made to establish the identity of operators of inactive mines.

Channel samples were collected in the field from each megascopically recognizable layer of the coal bed being studied. Field notes included a megascopic description of the coal bed by layers and, where possible, a measured section was made of the overlying and underlying rock strata at the site.

In the laboratory, the coal was crushed to 30 mesh, pelletized in lucite, and a polished surface was prepared for microscopic analysis. A split of each layer sample was dried, and an ash analysis was made from the sample. All samples were examined under oil by plane and polarized reflected light using a Leitz Panphot microscope with 25X fluorite objective and 10X periplane oculars. The actual magnification was X310. Standard index oil of $n=1.515$ was rejected for these coals. An index oil adjusted to $n=1.600$ was prepared from a mixture of cedarwood oil and 1-bromonaphthalene to enhance reflectance differences of the coal components. The maceral group analysis (Koppe, 1960) of each sample was determined on the basis of 500 points using the Chayes method (Chayes, 1949, 1956).

Macerals are the organic coal components seen under the microscope. For simplification, analyses are reported in this paper in terms of the major maceral groups, namely vitrinoids, exinoids, micrinoids, and semi-fusinite and fusinite (fusinoids). *Vitrinoids* are composed of discrete portions of plant tissue and finely fragmented matrix material which have about the same reflectance in the gray range. Vitrinoids become plastic and release volatiles upon heating. This group encompasses the bulk of reactive material in coals. *Exinoids* are those remains of waxy spores and cuticles which retain an ability to become fluid upon heating. Exinoids, as used in this report on medium- and low- volatile coals, excludes cuticular or spore-derived substances which are metamorphosed into substances analogous to vitrinites or into highly carbonized constituents that may be relatively inert upon heating.

Micrinoids and *fusinoids* are the essentially inert components of coal. These substances are already highly carbonized and apparently do not react significantly when heated in a reducing atmosphere. *Micrinoids* are massive or fine highly reflective particles of metamorphosed resin rodlets, cuticles, spores, and miscellaneous inert fragments. *Fusinoids* are lenses or bands of carbonified tissues which retain vestiges of plant cellular organization. The group includes minor amounts of tissues which are more

highly carbonified than the vitrinoids but still are somewhat reactive. For this reason, the fusinoids are reported as fusinite, (highly carbonified), and semi-fusinite (the intermediate components).

The resulting microscopical data were converted to percentages on an ash-free volumetric basis. Total seam data were calculated by multiplying the individual maceral percentage of every layer by the thickness of the layers, adding the totals for each maceral and dividing the results by the total thickness of the coal bed.

STRATIGRAPHY

This report is concerned with lower coal-bearing rocks of Pennsylvanian age found in the upper part of Pottsville, the Allegheny, and the lowermost portion of the Conemaugh Groups. A generalized stratigraphic column (Figure 2) illustrates the relative position of the important coal horizons discussed. The coal horizons are identified to assist the reader in relating the findings based on coal microscopy to the overall aspects of the rocks involved.

Figure 2 shows diagrammatically that the major coals and their associated underclays rest upon uneven erosional surfaces, in some cases having pronounced relief. Uneven depositional bases of coal beds and underclays are particularly noticeable in the rocks of Clearfield County. Similar strata farther west in Pennsylvania do not have such uneven depositional bases.

Coal strata developed upon uneven erosional bases lack uniform intervals between major coal horizons. This plus splitting of the coal into several benches, and occurrence of "stray" beds beneath the major horizon, often causes confusion in correlation or bed identification and may account for erratic test results.

CONEMAUGH GROUP COALS

The Conemaugh Group in Pennsylvania seldom contains coals of widespread importance. Most are thin, present only in local pods. This is the character of the two Conemaugh coals found in the Houtzdale quadrangle. These coals, the Mahoning coal and the Upper Freeport rider coal, are found very near the base of the group (Figure 2). Neither coal has much economic value and both coals have a reputation for having a high ash content. Consequently they are frequently removed with the overburden during stripping operations which are recovering the Upper Freeport coal beneath them. Locally, in the quadrangle, either the Upper Freeport rider or the overlying Mahoning is called the "F" coal by miners. The confusion is understandable in that neither horizon is persistent in the strata. The Upper Freeport rider coal locally lies directly upon the

CONEMAUGH

ALLEGHENY

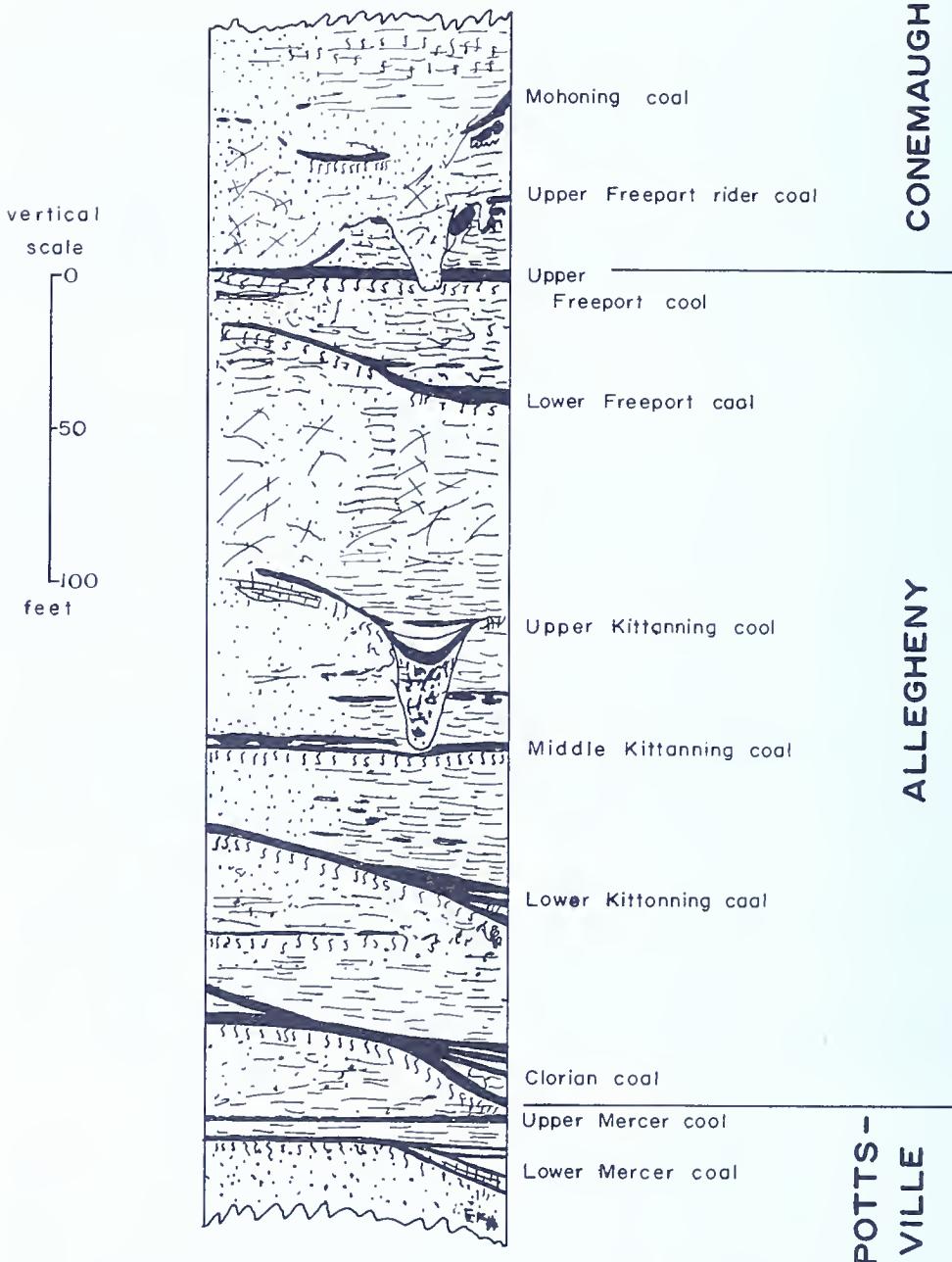
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Figure 2. Generalized stratigraphic column in Clearfield County.

Upper Freeport coal in the southern part of the area. The Mahoning rarely is less than 35 feet above the Upper Freeport and more generally is found between 35 feet and 70 feet above the Upper Freeport horizon.

The data given below (Appendix, Samples 85-C-22,-38,-85) are presented simply as petrographic records of the coal beds which were encountered during the investigation. Sample sites are indicated in Figure 3.

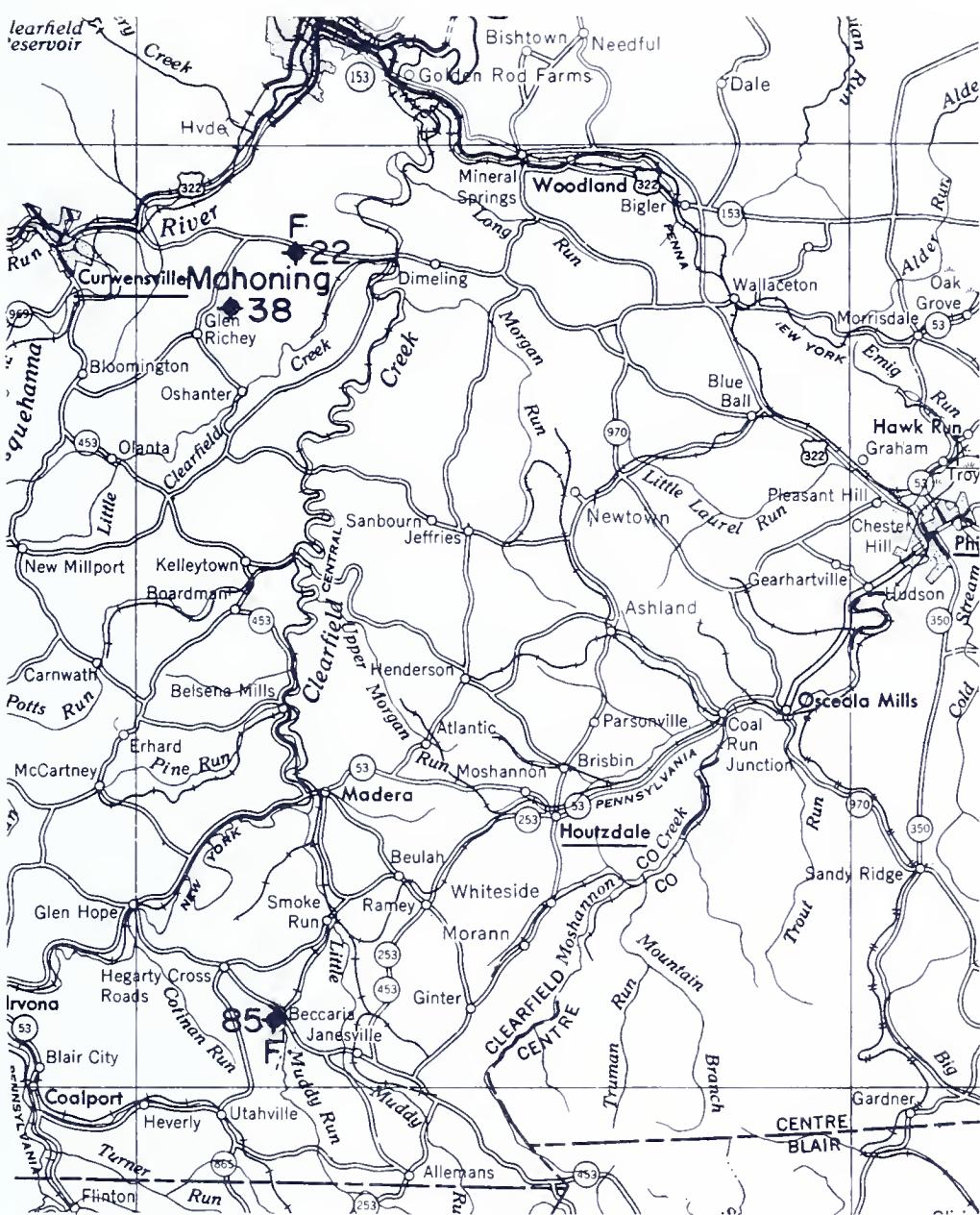


Figure 3. Location of samples collected from Conemaugh coals.

ALLEGHENY COALS

The important economic coals of the Houtzdale quadrangle are found in the strata of the Allegheny Group. The coals are treated in their stratigraphic order from the uppermost beds downward (Figure 2). Early mining in the Houtzdale area concentrated on the thicker phases of the Upper Freeport, the Lower Freeport, and the Lower Kittanning coals. As

a result, considerable portions of these beds have been mined out by underground mining methods. Only a few deep mines are still operating. Present production from these beds is from coal left near the outcrop which is amenable to modern strip mining techniques.

Upper Freeport Coal

The Upper Freeport coal (E, or Cap Seam) in the Houtzdale quadrangle is usually a single persistent bed averaging about 30 inches thick. The coal is characteristically clean and bright, having only one or two thin partings near the base. Sulfur content is generally low. In some areas the coal has been removed or reduced in thickness by erosion. In these areas a sandstone unit replaces the normal dark gray shale roof rock.

The Upper Freeport is present in the Houtzdale syncline in the southern part of the quadrangle and in the Clearfield syncline in the northwestern corner. In addition, some local uneroded patches are found on hilltops. In some areas of western Pennsylvania, the overlying Upper Freeport rider coal rests directly on the Upper Freeport seam. The two coals are together in some localities very near the southern and western edge of the quadrangle. Consequently, there is a possibility of such an occurrence locally in the Houtzdale area.

Nine samples were collected for examination from the locations shown in Figure 4. Table 1 summarizes the results of the petrographic analysis of the bed. The columns studied contained about 90 percent vitrinoids.

The total ash concentration determined for the samples varies between 5.5 and 9.6 percent, well within the range of coal usable for industrial purposes. BTU values should be extremely high relative to the other coals of the district.

Coal layers within the Upper Freeport bed have similarities which permit widespread correlations throughout. Figure 5 and Table 2 are presented to show the lateral continuity of the layers in the quadrangle. If we assume that relatively constant chemical and physical properties existed from place to place at the same time in the Upper Freeport coal-forming swamp then these data may be interpreted to suggest that the coal was deposited synchronously, except for the lowest benches.

The marked differences between the petrographic analysis of the Upper Freeport coal and those obtained from the Upper Freeport rider coal (Appendix, Samples 85-C-22 and 85) will explain why the total coal behaves in an abnormal fashion when the two beds are mined together. Often the higher coal is not recognized by the coal producer when it rests directly on the Upper Freeport bed.

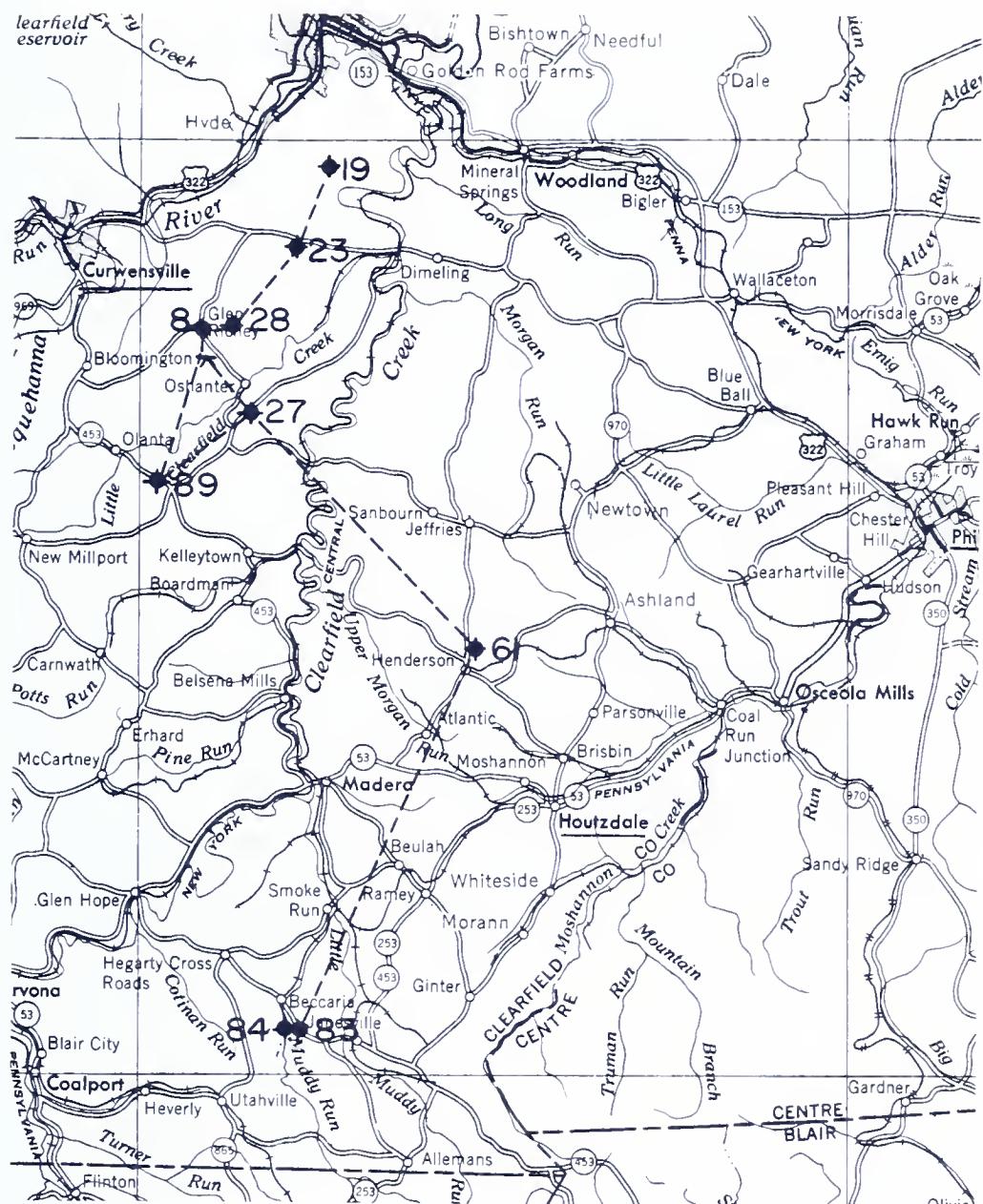


Figure 4. Location of samples collected from the Upper Freeport coal.

Lower Freeport Coal

The Lower Freeport coal (D. or Moshannon) in this quadrangle is found about 30 to 60 feet below the Upper Freeport. Although persistent throughout the quadrangle, it is quite variable both in thickness and in quality. In the southeastern quarter of the area, the coal is often more

Table 1. Petrographic composition of the Upper Freeport coal.

TOTAL BED

| Column Sample No. | Vitrinoids | Exinoids | Micrinoids | Semi-fusinite | Fusinite | Ash |
|----------------------|------------|------------------------------|------------|---------------|----------|--------|
| 23 | 90.1 | 1.7 | 2.7 | 0.5 | 5.0 | 8.4 |
| 28 | 93.7 | 2.0 | 1.8 | 0.4 | 2.1 | 7.0 |
| 8° | 94.3 | 0.8 | 2.0 | 0.6 | 2.3 | 8.7 |
| 19° | - | too weathered for microscopy | | | - | (13.0) |
| 89 | 91.9 | 2.6 | 2.1 | 0.7 | 2.7 | 9.6 |
| 27 | 91.8 | 1.8 | 2.8 | 0.3 | 3.3 | 8.7 |
| 61 | 92.0 | 3.1 | 2.6 | 0.6 | 1.7 | 8.0 |
| 83 | 93.8 | 2.6 | 1.5 | 0.1 | 2.0 | 9.6 |
| 84 | 91.7 | 1.4 | 2.9 | 1.3 | 2.7 | 5.5 |
| Average | 92.4 | 2.0 | 2.3 | 0.6 | 2.7 | 8.2 |

* severely weathered

than 6 feet thick. Elsewhere, the coal may consist of one or more benches separated from each other by 15 to 30 feet of rock.

In the Clearfield syncline the coal is usually a single bed about 36 inches thick. Locally, a thin, dirty upper bench is encountered up to 30 feet above the persistent coal horizon.

Generally, the coal is moderately bright, and contains numerous thin knife-edge partings of fusain or clay. Also, three or more clay partings, 1 to 3 inches thick, may separate the bed into distinctive benches, thus giving the coal seam an overall stratified appearance. In some parts of

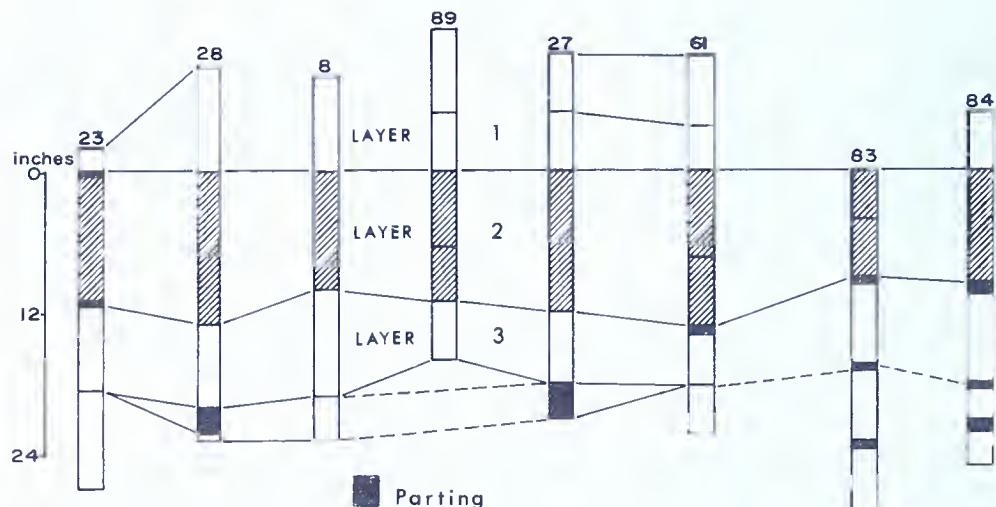


Figure 5. Correlation of the Upper Freeport coal bed by layers having similar petrographic analyses.

the Glen Richey quadrangle, a layer of canneloid coal or shale caps the bed. If the thicker partings and the canneloid layer are excluded, the coal contains a low percentage of ash. Like the Upper Freeport coal, the sulfur content is low.

Twelve samples of coal were collected from this coal zone at the locations shown in Figure 6. Table 3 presents the overall petrographic composition of the coal in the quadrangle. The spread of the data in Table 3 may indicate that, at least in part, the coal had different histories

Table 2. Upper Freeport coal — petrographic composition by layers.

| <i>Layer 1</i> | | <i>Percent</i> | | | | |
|----------------|--|-------------------|-----------------|-------------------|----------------------|-----------------|
| <i>Column</i> | | <i>Vitrinoids</i> | <i>Exinoids</i> | <i>Micrinoids</i> | <i>Semi-fusinite</i> | <i>Fusinite</i> |
| Sample No. | | | | | | |
| 23 | | 88.4 | 2.2 | 3.8 | 0.6 | 5.0 |
| 28 | | 89.6 | 2.8 | 3.4 | 0.8 | 3.4 |
| 8* | | 92.8 | 1.2 | 2.8 | - | 3.2 |
| 89 | | 89.2 | 4.6 | 2.4 | 0.4 | 3.4 |
| 27 | | 88.4 | 2.9 | 3.1 | 0.6 | 5.0 |
| 61 | | 89.0 | 5.3 | 3.1 | 1.4 | 1.2 |
| 84 | | 91.4 | 1.8 | 5.0 | 1.0 | 0.8 |
| Average | | 89.7 | 3.5 | 3.1 | 0.7 | 3.0 |
| <i>Layer 2</i> | | | | | | |
| 23 | | 91.0 | 2.4 | 2.2 | 1.0 | 3.4 |
| 28 | | 96.4 | 1.6 | 0.8 | - | 1.2 |
| 8* | | 98.4 | 0.4 | 1.2 | - | - |
| 89 | | 95.5 | 1.4 | 1.3 | 0.4 | 1.4 |
| 27 | | 94.8 | 1.2 | 2.0 | - | 2.0 |
| 61 | | 95.0 | 2.4 | 1.4 | - | 1.2 |
| 83 | | 95.6 | 1.9 | 1.4 | - | 1.1 |
| 84 | | 92.8 | 1.6 | 2.2 | 0.4 | 3.0 |
| Average | | 94.9 | 1.6 | 1.6 | 0.2 | 1.7 |
| <i>Layer 3</i> | | | | | | |
| 23 | | 94.0 | 1.4 | 1.6 | - | 3.0 |
| 28 | | 93.6 | 2.0 | 1.6 | 0.8 | 2.0 |
| 8 | | 91.4 | 0.6 | 2.0 | 2.0 | 4.0 |
| 89 | | 90.4 | 0.4 | 3.2 | 2.0 | 4.0 |
| 27 | | 92.0 | 1.0 | 3.8 | 0.2 | 3.0 |
| 61 | | 92.0 | 1.8 | 3.0 | 0.2 | 3.0 |
| 83 | | 94.2 | 2.0 | 1.4 | - | 2.4 |
| Average | | 92.0 | 1.3 | 2.5 | 1.0 | 3.2 |

* severely weathered

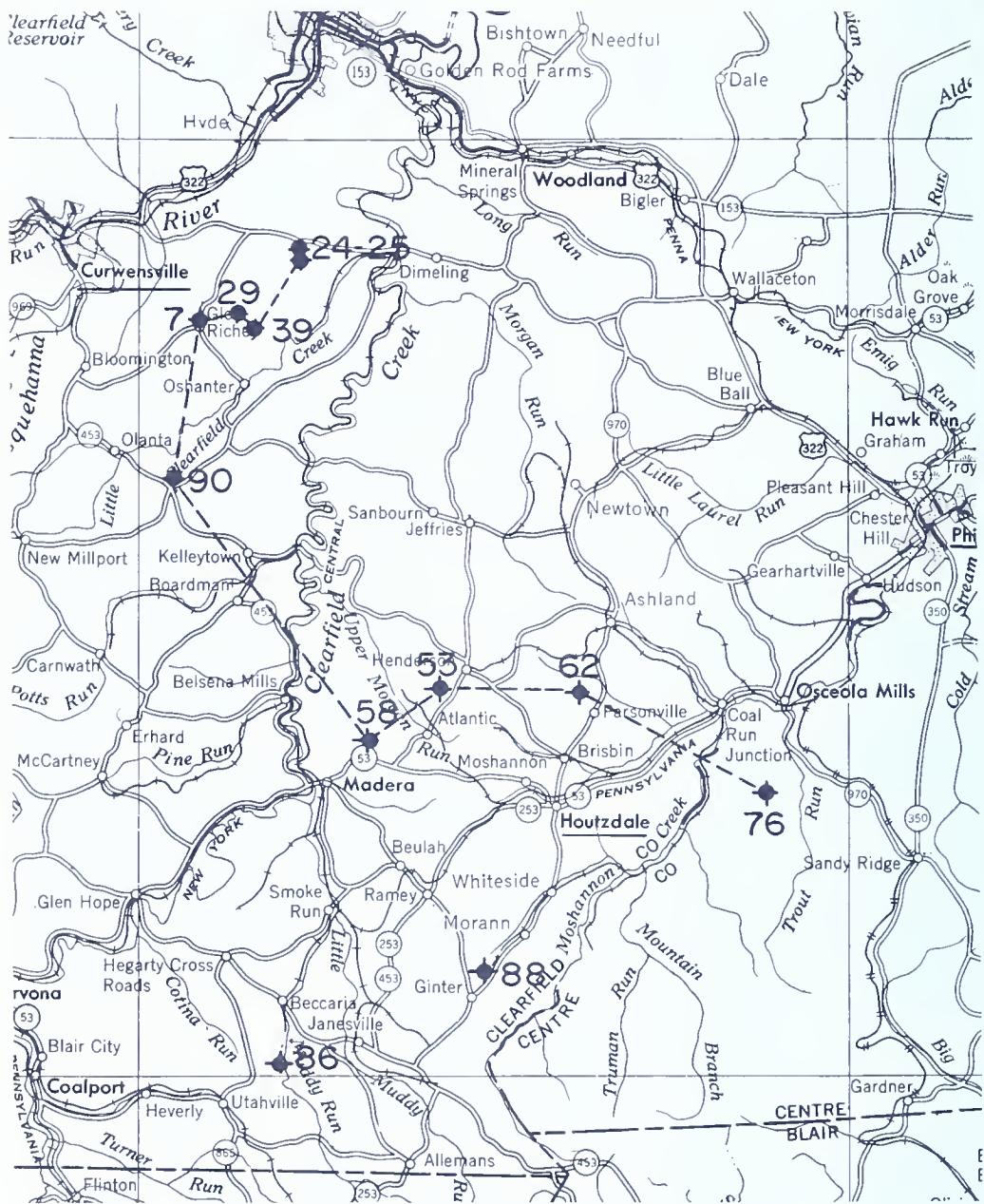


Figure 6. Location of samples collected from the Lower Freeport coal.

of development in various parts of the area. Figure 7 shows correlations made between some of the sites based upon petrographic similarities of layers. The average maceral compositions of the layers correlated in Figure 7 are given in Table 4. The analysis of the total Lower Freeport in the Houtzdale quadrangle is not constant throughout the area. Chemical and physical properties of the coal from one locality should not be inferred over long distances.

Table 3. Petrographic composition of the Lower Freeport coal.

| Sample No. | Vitrinoids | Exinoids | Micrinoids | Fusinoids | | Thickness | |
|------------------|------------|-----------|------------|---------------|----------|-----------|--------|
| | | | | Semi-fusinite | Fusinite | Ash | Inches |
| 7 | 87.7 | 1.0 | 5.2 | 1.1 | 5.0 | 9.5 | 38 |
| (24) | — | weathered | — | — | — | 8.8 | 29 |
| 25 | 90.5 | 1.8 | 3.6 | 0.7 | 3.4 | 9.5 | 33 |
| 29 | 89.0 | 2.0 | 4.9 | 0.6 | 3.5 | 8.0 | 37 |
| 39 | 87.8 | 4.1 | 4.6 | 1.5 | 2.0 | 8.8 | 34 |
| 53 | 88.6 | 2.8 | 3.5 | 1.9 | 3.2 | 4.2 | 55 |
| 58 | 91.9 | 1.6 | 2.8 | 0.4 | 3.3 | 6.1 | 37½ |
| 62 | 87.0 | 1.5 | 5.0 | 1.1 | 5.4 | 6.5 | 69 |
| 71° | 89.7 | 4.1 | 2.7 | 1.2 | 2.3 | 10.1 | 28 |
| 76 | 88.3 | 2.2 | 4.3 | 1.5 | 3.7 | 8.2 | 75 |
| 86 | 91.5 | 1.9 | 2.5 | 0.9 | 3.2 | 6.8 | 26 |
| (87)-upper split | — | — | — | — | — | (30.8) | |
| 88 | 89.4 | 3.1 | 5.1 | 0.2 | 2.2 | 8.0 | 30½ |
| 90 | 84.2 | 3.4 | 4.3 | 1.3 | 6.8 | 6.9 | 22 |
| Average | 88.7 | 2.3 | 4.2 | 1.0 | 3.8 | 7.5 | |

* partial-(87) excluded from totals

The lower layers of the Lower Freeport coal occur only in the southeastern half of the Houtzdale quadrangle (Layer 5 to base of coal shown in Figure 7) and were formed in the Houtzdale Basin, which probably existed only in the southern half of the quadrangle. These layers are assumed to have been deposited before coal-forming conditions reached the northwest part of the area. Thus, the Lower Freeport coal in the Clearfield syncline of the Glen Richey 7½-minute quadrangle (Figure 7) is younger than the bulk of the thick Lower Freeport coal in the Ramey and Houtzdale 7½-minute quadrangles. The coal in the southern part of the Glen Richey 7½-minute quadrangle (Figure 6, #90) accumulated when coal-forming conditions ultimately submerged the topographic high which separated the Clearfield Basin coal from the basin to the southeast. There is little petrographic data to suggest that the separated upper coal bench (Figure 7, layer 2) in the Glen Richey quadrangle was connected with the uppermost persistent layers of the coal in the southeast. There is some evidence, however, (Appendix, Column 76) that the canneloid shale of the northwest is present just above layer 1 in the southeastern part of the quadrangle.

The decrease in vitrinoid content along with increases in micrinoid and fusinoid content in successively higher coal layers (Shown in Table 4) are typical of the normal sequence of coal deposition in the Houtzdale quadrangle. Layers 3 and 4 have almost identical average petrographic analyses and could well be combined were it not for the extremely persistent parting which separates them in the Clearfield syncline.

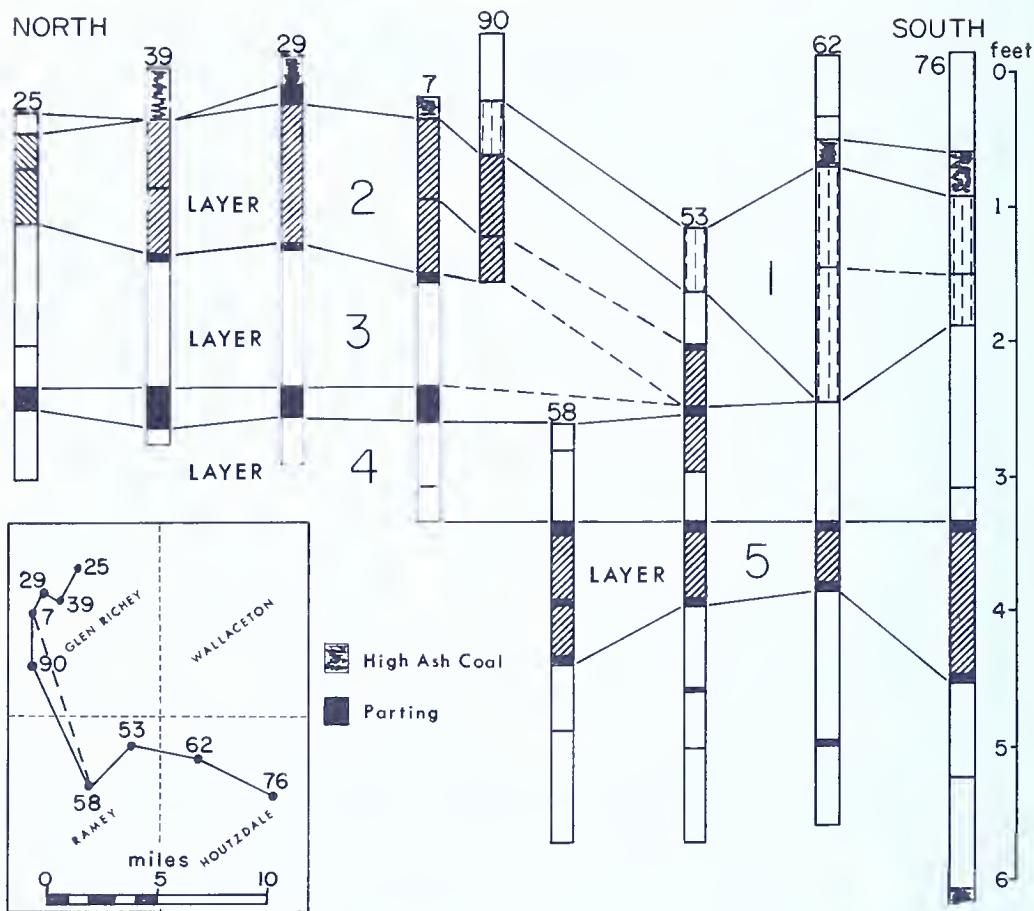


Figure 7. Correlation of the Lower Freeport coal by layers having similar petrographic analyses.

Upper Kittanning Coal

The Upper Kittanning (C') coal is present generally between 50 and 90 feet below the Lower Freeport coal. It is not a persistent coal in much of the quadrangle. Where found, it varies greatly in thickness, number of beds, and quality. This locally important coal usually is found as one of the rock types filling a pre-Upper Kittanning stream channel which had been deeply eroded into underlying strata (Figure 2). The channel fill may include as many as five coal beds separated by clays, mudstones, and siltstones. The thickness ranges from mere streaks of coaly shale to coal beds more than 6 feet thick. The coal either is missing, or is a relatively thin single bed when not related to a channel.

The basal bed of coal (not sampled) near Mineral Springs is more than 5 feet thick in the center of the ancient channel. Another bed at that site is about 2 feet thick (Sample 85-C-20). A few hundred feet away, both coals are missing.

Table 4. Lower Freeport coal — summary of average maceral composition by layers.

| <i>Bed Layer</i> | Vitrinoids | Exinoids | Micrinoids | Fusinoids |
|------------------|------------|----------|------------|-----------|
| 1 | 76.7 | 2.4 | 8.0 | 12.9 |
| 2 | 86.3 | 2.4 | 5.1 | 6.2 |
| 3 | 89.9 | 1.8 | 3.5 | 4.8 |
| 4 | 90.0 | 1.3 | 4.3 | 4.4 |
| 5 | 93.7 | 1.9 | 1.3 | 3.1 |

(1) includes semi-fusinite

Similar channel deposits of thick Upper Kittanning coal less than 800 feet wide found at several places in western Pennsylvania (Figure 8) are grouped into a linear pattern suggesting that a major pre-Upper Kittanning river channel system (or systems) may have crossed the Allegheny Plateau in an east-west direction. The Upper Kittanning cannel coal deposits west of the study area have been interpreted as peat accumulations in oxbows of major river systems (Ashley, 1918; Fettke, 1923).

Only the uppermost layer tends to be canneloid in the coals of the Houtzdale quadrangle. Table 5 summarizes the data from places indicated in Figure 9. Because of the sporadic distribution and local nature of the deposits, no attempt was made to correlate the petrography in the quadrangle. Although the coal most often has a high ash content, the sulfur concentration is usually low.

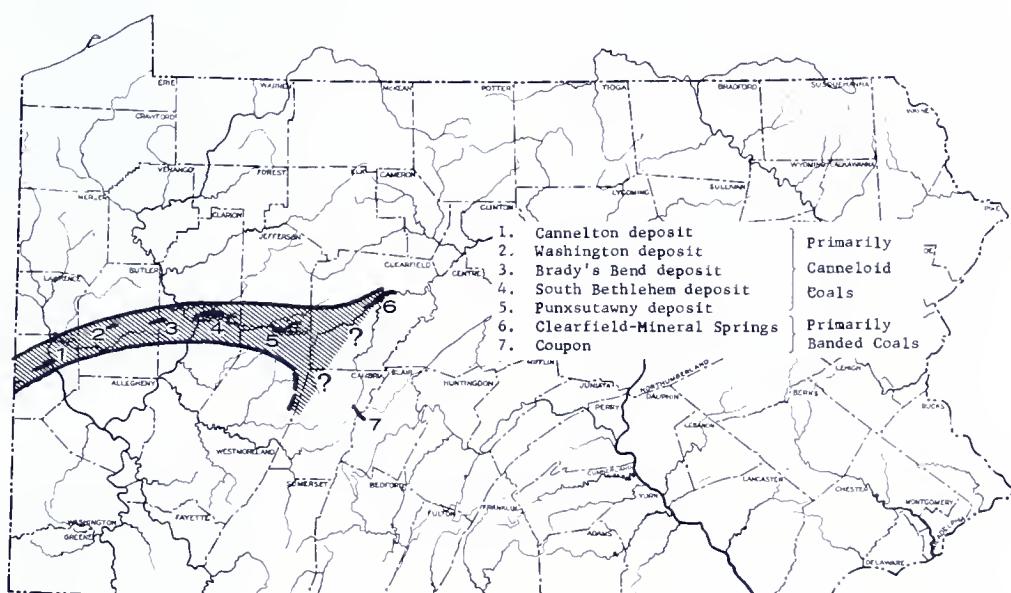


Figure 8. Major pre-Upper Kittanning drainage system in western Pennsylvania.

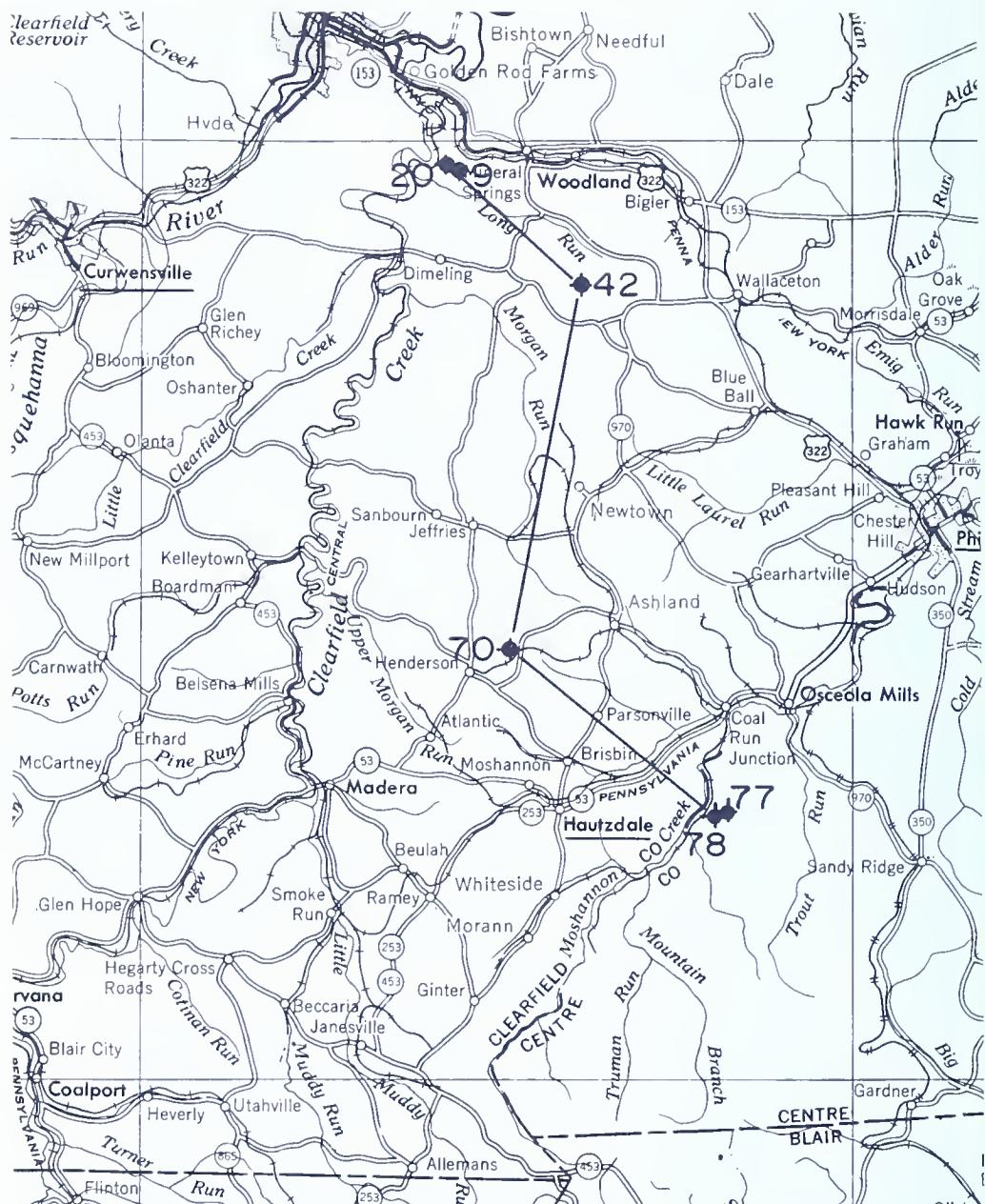


Figure 9. Location of samples collected from the Upper Kittanning coal.

Middle Kittanning Coal

The Middle Kittanning (C) coal is found between 130 and 160 feet below the Upper Freeport coal horizon and 45 to 60 feet above the main-mined beds of the Lower Kittanning coal (Figure 2). Like the other coals of the Houtzdale area, at many localities it has more than a single bed. In the central part of the quadrangle particularly, and to the southeast,

Table 5. Petrographic composition of the Upper Kittanning coal.

| <i>Column</i> | <i>Vitrinoids</i> | <i>Exinoids</i> | <i>Micrinoids</i> | <i>Semi-fusinite</i> | <i>Fusinite</i> | <i>Ash</i> |
|---------------|-------------------|-----------------|-------------------|----------------------|-----------------|------------|
| Sample No. | | | | | | |
| 9 | 87.5 | 0.9 | 4.2 | 1.7 | 5.7 | 19.9 |
| 20 | 85.8 | 2.6 | 3.4 | 1.9 | 6.3 | 16.2 |
| 42 | 84.8 | 3.1 | 3.0 | 1.2 | 7.9 | 12.9 |
| 70 | 75.0 | 5.3 | 4.0 | 1.0 | 14.7 | 7.6 |
| 77x | 91.5 | 4.3 | 2.4 | 0.5 | 1.3 | 9.5 |
| 78xx | 76.6 | 5.0 | 4.1 | 1.7 | 12.6 | 6.3 |
| Average | 83.6 | 3.5 | 3.5 | 1.3 | 8.1 | 12.1 |

x upper bed
xx lower bed

the seam tends to split and may be present as a double- or triple-bedded coal. The Middle Kittanning seam is extremely persistent and is usually more than 2 feet thick. Often there is a single high ash layer in the center of the coal, as shown in Sample 85-C-63. Other clayey partings are more local in nature. There is a tendency for the Middle Kittanning coal to have a moderately high percentage of sulfur which may be related to pyrite-rich marine sediments overlying the coal. However, it is a good steam coal when the sulfur and ash content is reduced.

The Middle Kittanning coal has recently become more important to miners because of the decrease of readily available reserves of thicker Freeport and Lower Kittanning coals.

Figure 10 shows locations of the samples reported below. The total composition of the Middle Kittanning coal at these sites is recorded in Table 6. An average vitrinoid content near 90 percent with only 6.5 percent average total inerts indicates that this coal compares favorably with the best coals of the Houtzdale area if mineral matter and pyrite concentrations are not considered.

Abnormally thick coal was collected at the Wilks Mine (Sample 85-C-37). The increase is due to presence of benches below the 27-inch level. The presence of these additional coal layers suggests that a restricted local swamp deposit developed in this vicinity prior to the covering of the quadrangle by the coal swamp in which the remaining Middle Kittanning formed. The coal layer above the 27-inch level is typical of the lowermost bed in the Middle Kittanning sequence (Figure 11).

Lower Kittanning Coal

The Lower Kittanning ("B" or Miller) is probably the most important coal in the Allegheny Group. It is almost everywhere a thick, minable coal. The coal is found between 165 and 220 feet below the Upper Freeport coal, but usually at about 200 feet in the Houtzdale quadrangle.

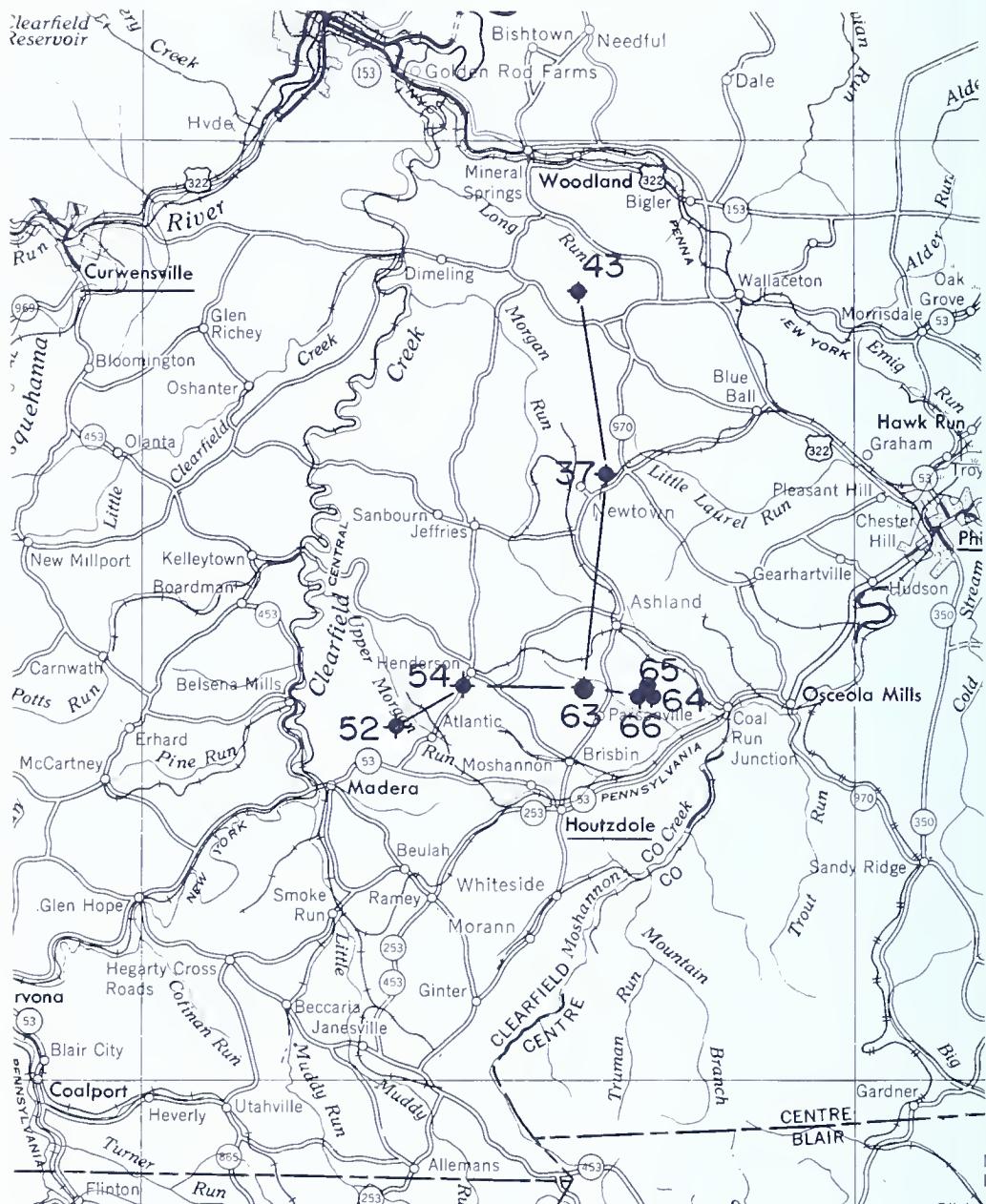


Figure 10. Location of samples collected from the Middle Kittanning coal.

The coal consists of several beds in this area, unlike its occurrence as a single bed farther west in Pennsylvania. Figure 12 illustrates the number of coal beds included in the interval of the Lower Kittanning Formation in the Houtzdale quadrangle. For ease of understanding, the beds are numbered. At this time it is not definitely known which of the beds becomes the persistent single-bedded coal elsewhere in Pennsylvania.

Table 6. Petrographic composition of the Middle Kittanning coal.

| Sample No. | Vitrinoids | Exinoids | Micrinoids | Fusinoids | | Thickness | |
|------------|------------|----------|------------|---------------|----------|-----------|--------|
| | | | | Semi-fusinite | Fusinite | Ash | Inches |
| 37 | 94.5 | 1.7 | 1.6 | 0.1 | 2.1 | 7.9 | 58 |
| 43 | 84.6 | 4.3 | 5.5 | 1.8 | 3.8 | 10.1 | 26½ |
| 52 | 90.1 | 2.8 | 2.7 | 0.9 | 3.5 | 6.5 | 23 |
| 54 | 87.8 | 2.8 | 3.6 | 1.3 | 4.5 | 6.6 | 27½ |
| 63 | 90.4 | 3.5 | 2.0 | 0.9 | 3.2 | 11.6 | 39 |
| 64 | 90.4 | 3.8 | 2.0 | 1.2 | 2.6 | 8.7 | 30 |
| 65 | 87.8 | 4.3 | 5.2 | 0.7 | 2.0 | 10.8 | 22 |
| 66 | 89.8 | 5.4 | 3.7 | 0.2 | 0.9 | 6.3 | 18½ |
| Average | 89.4 | 3.6 | 3.3 | 0.9 | 2.8 | 8.6 | |

Beds B-2 and B-3 represent the main-mined portion of the coal and are "the" Lower Kittanning Coal of earlier writers. All of the remaining beds are strip mined locally, but usually only during recovery of beds B-2 and B-3. The main-mined coal is more than 40 inches thick excluding the 6- to 9-inch parting separating beds B-2 and B-3. Table 7 summarizes the average composition recorded for the beds numbered in Figure 12. Sites of samples reported in Table 8 are shown in Figure 13.

The bottom bed (B-1) is found only in local discontinuous deposits, suggesting that these deposits were formed in the troughs that filled with peat before the advance of the widespread swamp conditions which formed the later extensive beds of the area. Because of the local podlike distribution of B-1, the character and quality is quite variable (Table 8). Generally B-1 has a fairly low percentage of sulfur, but contains a high percentage of other mineral matter. It is often left undeveloped during mining.

The overlying widespread bed (B-2), is very closely related to B-1 petrographically. The two can be distinguished only by a comparison of the exinoid value (Table 7). B-1 tends to contain about half as much exinoid as micrinoid. B-2 on the other hand, generally has more nearly equal proportions of these components. B-2 has a high percentage of sulfur and mineral matter. When mined and combined with the immediately overlying B-3 bed, these high percentages are reduced permitting more widespread value from bed B-2 than it would have were it not associated with B-3.

Coal layer B-3 has the lowest percentage of ash and sulfur of the Lower Kittanning complex. The thickness of B-3 varies greatly throughout the quadrangle (Table 8). To the northeast, a secondary bed (B3b) splits from the top of B-3. This local split sometimes is thick enough to be recovered. Petrographically it is unlike the beds above or below and when present serves as a distinctive marker.

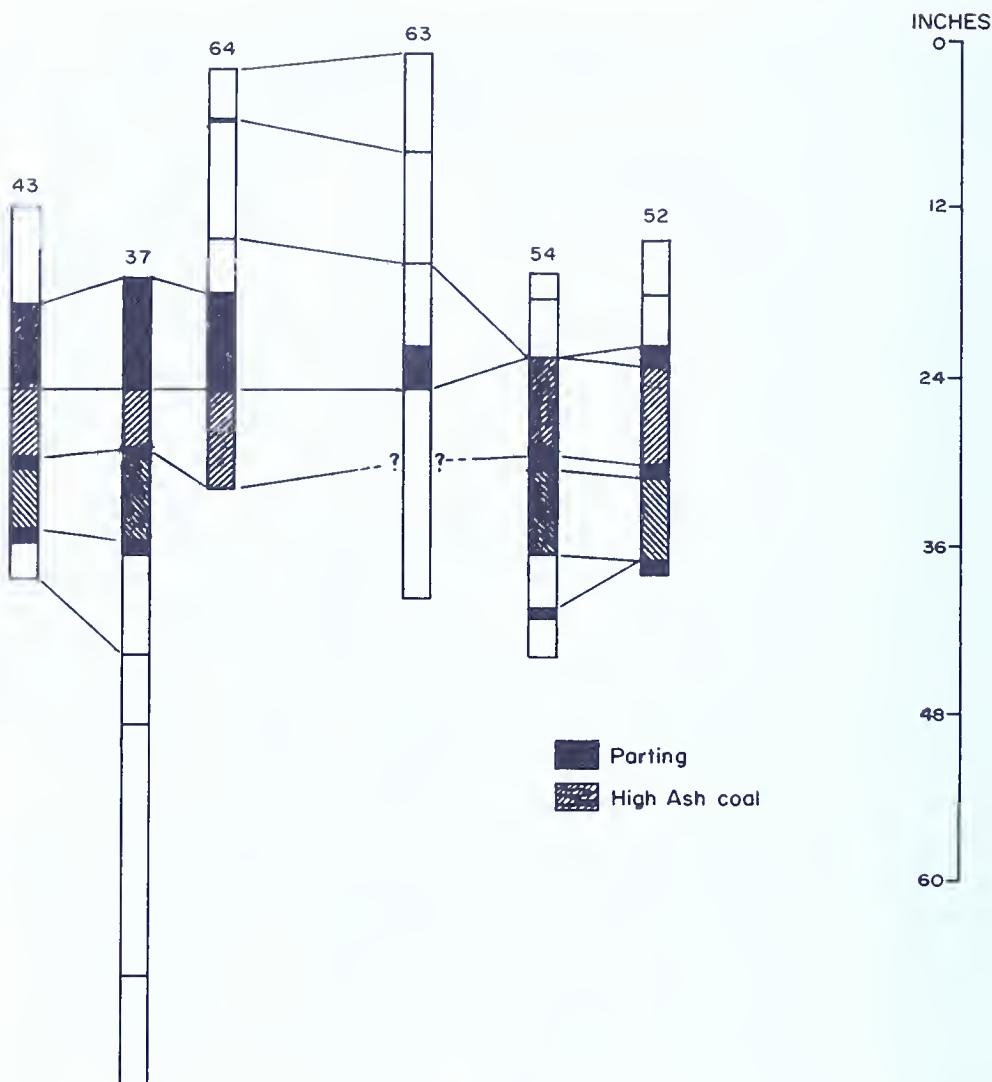


Figure 11. Correlation of the Middle Kittanning coal by layers having similar petrographic analyses.

The coal layer B-4, sometimes called the Lower Kittanning rider coal, is almost 20 feet above B-3a. The bed is persistent, seldom more than a foot thick, but has a remarkably low percentage of ash throughout. It has an analysis reminiscent of bed B-3a. When sufficiently thick, it is recovered.

The top unit (B-5) is discontinuous, has a high percentage of ash and is seldom recovered. Very often the horizon has been removed by erosion. The petrographic data on B-5 are presented for completeness of all coals found in the Lower Kittanning coal complex of the Houtzdale quadrangle.

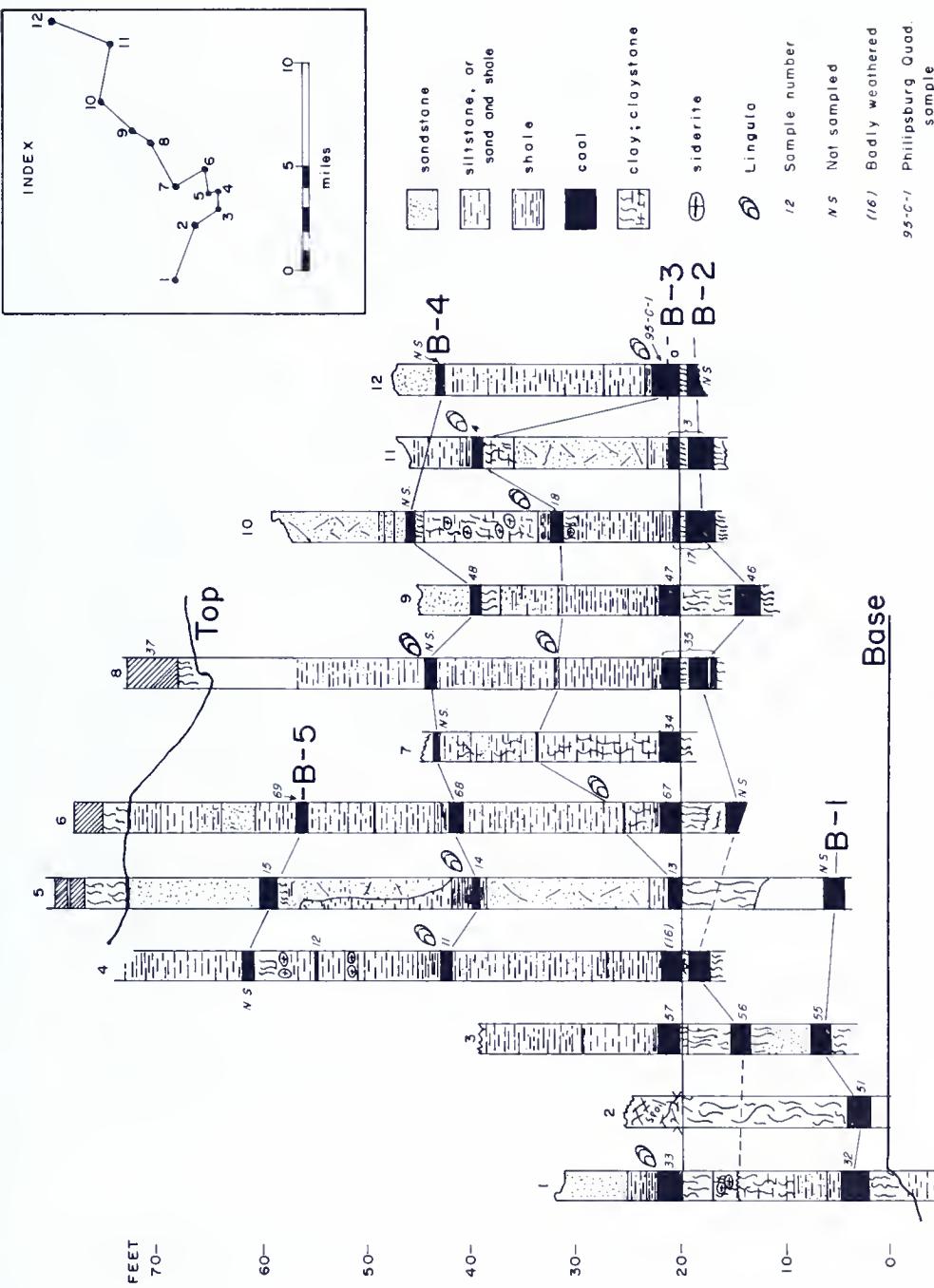


Figure 12. Coal beds of the Lower Kittanning Formation.

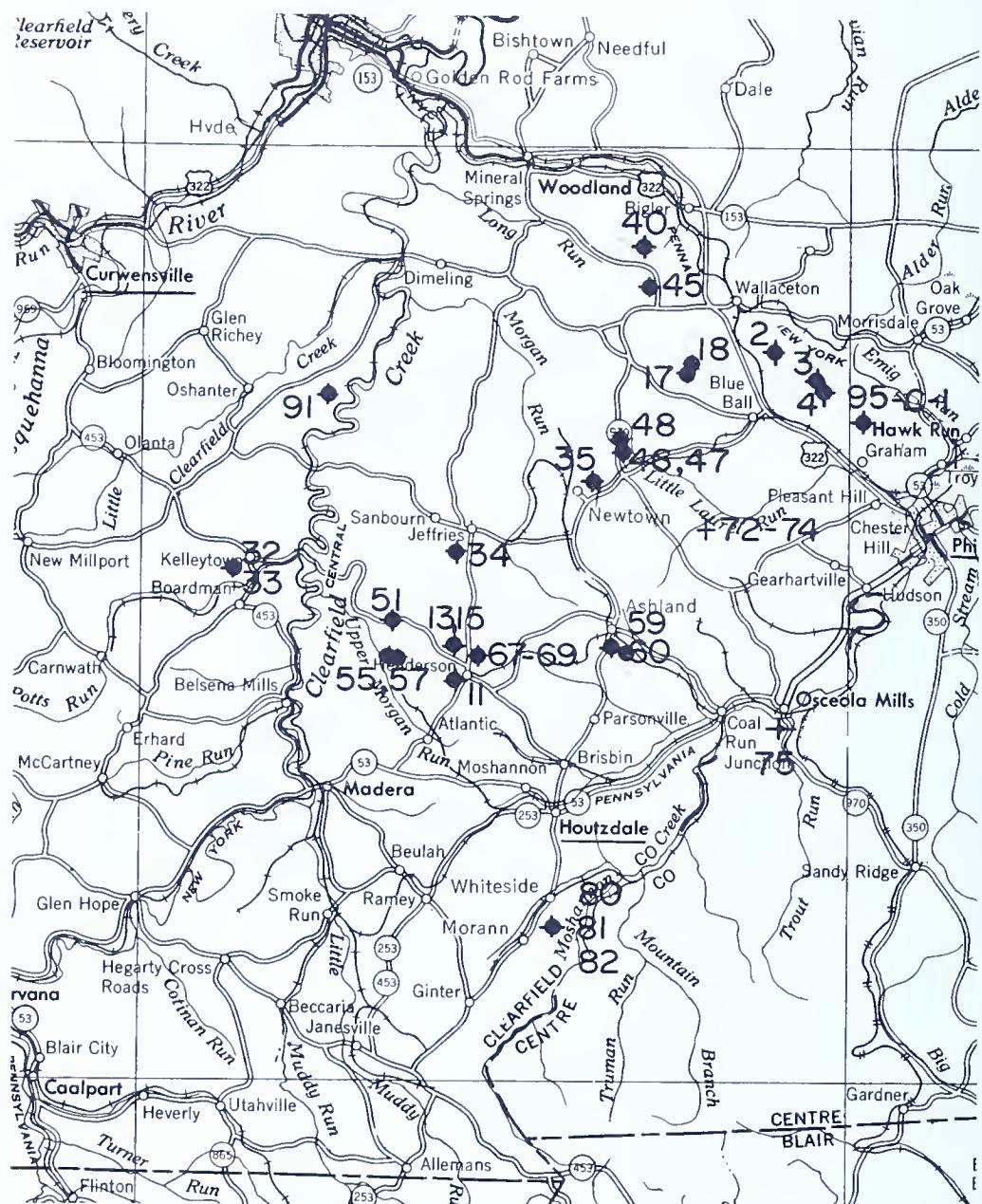


Figure 13. Location of samples collected from the Lower Kittanning coal.

Clarion Coals

The minable Clarion (A', A, Brookville, Three-Foot) coals are usually present between 60 and 100 feet below the Lower Kittanning (B-3) horizon. In the Houtzdale quadrangle, three coals are recognized. For convenience, they are designated Clarion 1 (lowest), Clarion 2 (middle), and Clarion 3 (uppermost). In the southern part of the area, the coals are

Table 7. Average petrographic composition of the Lower Kittanning coal complex.

| Bed No. | Vitrinoids | Exinoids | Micrinoids | Fusinoids | | Ash | Number of Samples |
|---------|------------|----------|------------|---------------|----------|------|-------------------|
| | | | | Semi-fusinite | Fusinite | | |
| 5 | 87.1 | 2.3 | 3.0 | 1.8 | 5.8 | 14.1 | 3 |
| 4 | 93.2 | 3.5 | 2.2 | 0.3 | 0.8 | 6.6 | 6 |
| 3b | 86.2 | 5.7 | 4.7 | 0.7 | 2.7 | 8.0 | 8 |
| 3a | 92.2 | 3.1 | 2.4 | 0.6 | 1.7 | 6.5 | 17 |
| 2 | 84.7 | 4.2 | 4.9 | 1.4 | 4.8 | 12.3 | 5 |
| 1 | 86.5 | 2.4 | 4.6 | 1.6 | 4.9 | 9.2 | 4 |

together. There they have an aggregate thickness of about 6 feet. The top coal, however, is seldom usable because of a high percentage of ash. To the north, the three coals are separated by twelve or more feet. Locally, the bottom coal is missing.

During the course of this study, no workable Clarion 3 coal was found. The horizon is very persistent over much of the area only as a coaly shale unit about a foot thick. Clarion 2 tends to be thicker than the underlying Clarion 1 and contains more sulfur than the lower bed. In addition, Clarion 2 often is canneloid at the top of the bed which gives the coal layer a blocky appearance. These characteristics aid in the identification of the coals in the field.

Table 9 contains a summary of the petrographic composition of the Clarion coals collected at sites shown in Figure 14. Comparison of the average values shows that Clarion 1 has more vitrinoids than Clarion 2 in this quadrangle.

POTTSVILLE COALS

Only one coal (Mercer) is exposed at the top of the Pottsville strata which underlie the valuable coals of the Allegheny Group. In the Houtzdale quadrangle, Pottsville coals are not economically important, but do serve as markers for establishing correlations for the economic clay horizons found both at the base of the Allegheny sequences and just beneath the Mercer coal horizon.

Although sought during the field work, the Quakertown coal was not found for sampling. The Quakertown horizon is normally about 100 feet below the Mercer coal.

Mercer Coal

Mercer coals are usually exposed only as a result of strip or underground mining operations for the valuable clay deposits lying beneath the lowest coal bed of the Houtzdale quadrangle. The Mercer horizon is found from 100 to 150 feet below the Lower Kittanning coal (B-2).

Table 8. Petrographic composition of beds in the Lower Kittanning coal complex.

| A. | Bed B-5 | Sample No. | Vitrinoids | Exonoids | Micrinoids | Semi-fusinite | Fusinite | Ash | Thickness Inches |
|----|----------|------------|------------|----------|------------|---------------|----------|-----|---------------------|
| | 15 | 84.2 | 3.1 | 3.1 | 2.0 | 7.6 | 12.3 | 20 | |
| | 69 | 90.2 | 1.3 | 2.8 | 2.3 | 3.4 | 12.5 | 14 | |
| | 74 | 87.0 | 2.4 | 3.1 | 1.0 | 6.5 | 17.5 | 9 | |
| | Average | 87.1 | 2.3 | 3.0 | 1.8 | 5.8 | 14.1 | | |
| B. | Bed B-4 | | | | | | | | |
| | 11 | 92.7 | 2.7 | 3.5 | 0.4 | 0.7 | 9.5 | 12½ | |
| | 14 | 90.5 | 3.6 | 3.9 | 0.9 | 1.1 | 11.4 | 11 | |
| | 48 | 93.9 | 4.6 | 1.1 | — | 0.4 | 3.5 | 9 | |
| | 59 | 95.4 | 2.0 | 1.5 | 0.1 | 1.0 | 6.9 | 11 | |
| | 68 | 92.8 | 4.0 | 1.4 | 0.3 | 1.5 | 3.1 | 11½ | |
| | 73 | 94.2 | 4.0 | 1.5 | 0.1 | 0.2 | 5.4 | 12½ | |
| | Average | 93.2 | 3.5 | 2.2 | 0.3 | 0.8 | 6.6 | | |
| C. | Bed B-3b | | | | | | | | |
| | 4 | 88.0 | 5.8 | 5.0 | 0.2 | 1.0 | 16.5 | 9 | |
| | 13 | 88.8 | 4.2 | 5.5 | 0.5 | 1.0 | 6.0 | 17 | |
| | 18 | 83.0 | 5.4 | 7.0 | 0.6 | 4.0 | 6.6 | 14 | |
| | 40# | 87.9 | 5.1 | 3.0 | 1.6 | 2.4 | 8.6 | 22 | |
| | 81# | 81.6 | 8.6 | 4.6 | — | 5.2 | 8.4 | 4 | |
| | 75# | 84.2 | 8.8 | 4.8 | 0.6 | 1.6 | 13.8 | 6 | |
| | 82 | 87.9 | 4.0 | 3.7 | 0.7 | 3.7 | 4.6 | 14 | |
| | 95-C-1b | 88.5 | 3.9 | 3.8 | 1.4 | 2.4 | 5.2 | 13 | |
| | Average | 86.2 | 5.7 | 4.7 | 0.7 | 2.7 | 8.0 | | |
| D. | Bed B-3a | | | | | | | | |
| | 2 | 92.0 | 3.0 | 2.6 | 0.6 | 1.8 | 3.5 | 12 | |
| | 3a | 92.0 | 4.4 | 2.0 | — | 1.6 | 4.4 | 9 | |
| | 17a | 92.6 | 4.2 | 2.5 | — | 0.7 | 10.0 | 6 | |
| | 33 | 93.0 | 2.4 | 2.5 | — | 2.1 | 8.8 | 16 | |
| | 34 | 94.4 | 1.9 | — | — | 0.7 | 5.8 | | |

Table 8. (Continued)

| | | Sample No. | Vitrinoids | Exinoids | Micrinoids | Semi-fusinite | Fusinite | Ash | Thickness Inches |
|----|---------|------------|------------|----------|------------|---------------|----------|------|---------------------|
| | | 35a | 91.5 | 2.8 | 3.0 | 1.3 | 1.4 | 6.6 | 21 1/2 |
| | | 40# | 91.2 | 3.6 | 3.2 | 0.4 | 1.6 | 8.2 | 6 |
| | | 45 | 91.3 | 3.3 | 2.6 | 0.3 | 2.5 | 3.8 | 20 |
| | | 47 | 92.5 | 3.5 | 2.0 | 0.9 | 1.1 | 5.9 | 17 1/2 |
| | | 57 | 91.9 | 3.3 | 2.6 | 0.9 | 1.3 | 6.5 | 21 1/2 |
| | | 60 | 91.1 | 3.2 | 2.3 | 0.8 | 2.6 | 6.6 | 23 1/2 |
| | | 67 | 93.1 | 3.2 | 2.3 | 0.3 | 1.1 | 4.5 | 22 |
| | | 72 | 91.0 | 3.7 | 2.1 | 1.2 | 2.0 | 5.6 | 23 |
| | | 75# | 92.0 | 2.4 | 2.2 | 1.2 | 2.2 | 6.3 | 26 1/2 |
| | | 81# | 91.7 | 3.0 | 2.0 | 0.1 | 3.2 | 7.4 | 14 |
| | | 91 | 94.0 | 2.2 | 2.5 | 0.3 | 1.0 | 7.5 | 22 |
| | | 95-C-1a | 92.8 | 2.7 | 1.9 | 0.8 | 1.8 | 9.2 | 12 1/2 |
| | | Average | 92.2 | 3.1 | 2.4 | 0.6 | 1.7 | 6.5 | |
| E. | Bed B-2 | 3b | 86.5 | 4.3 | 4.7 | 0.9 | 3.6 | 9.1 | 30 1/2 |
| | | 17b | 83.9 | 4.5 | 4.9 | 1.4 | 5.3 | 12.0 | 27 1/2 |
| | | 35b | 80.5 | 4.7 | 6.1 | 1.7 | 7.0 | 16.0 | 22 1/2 |
| | | 46 | 87.6 | 3.7 | 3.7 | 1.6 | 3.4 | 12.8 | 26 |
| | | 56 | 85.3 | 3.7 | 4.9 | 1.2 | 4.9 | 11.5 | 17 1/2 |
| | | Average | 84.7 | 4.2 | 4.9 | 1.4 | 4.8 | 12.3 | |
| F. | Bed B-1 | 32 | 87.4 | 1.9 | 4.9 | 0.9 | 4.9 | 8.6 | 21 |
| | | 51 | 83.8 | 2.9 | 5.4 | 1.9 | 6.0 | 12.1 | 25 |
| | | 55 | 87.8 | 2.5 | 3.7 | 2.2 | 3.8 | 6.1 | 21 |
| | | 80 | 87.2 | 2.4 | 4.2 | 1.4 | 4.8 | 10.0 | 48 1/2 |
| | | Average | 86.5 | 2.4 | 4.6 | 1.6 | 4.9 | 9.2 | |

partial

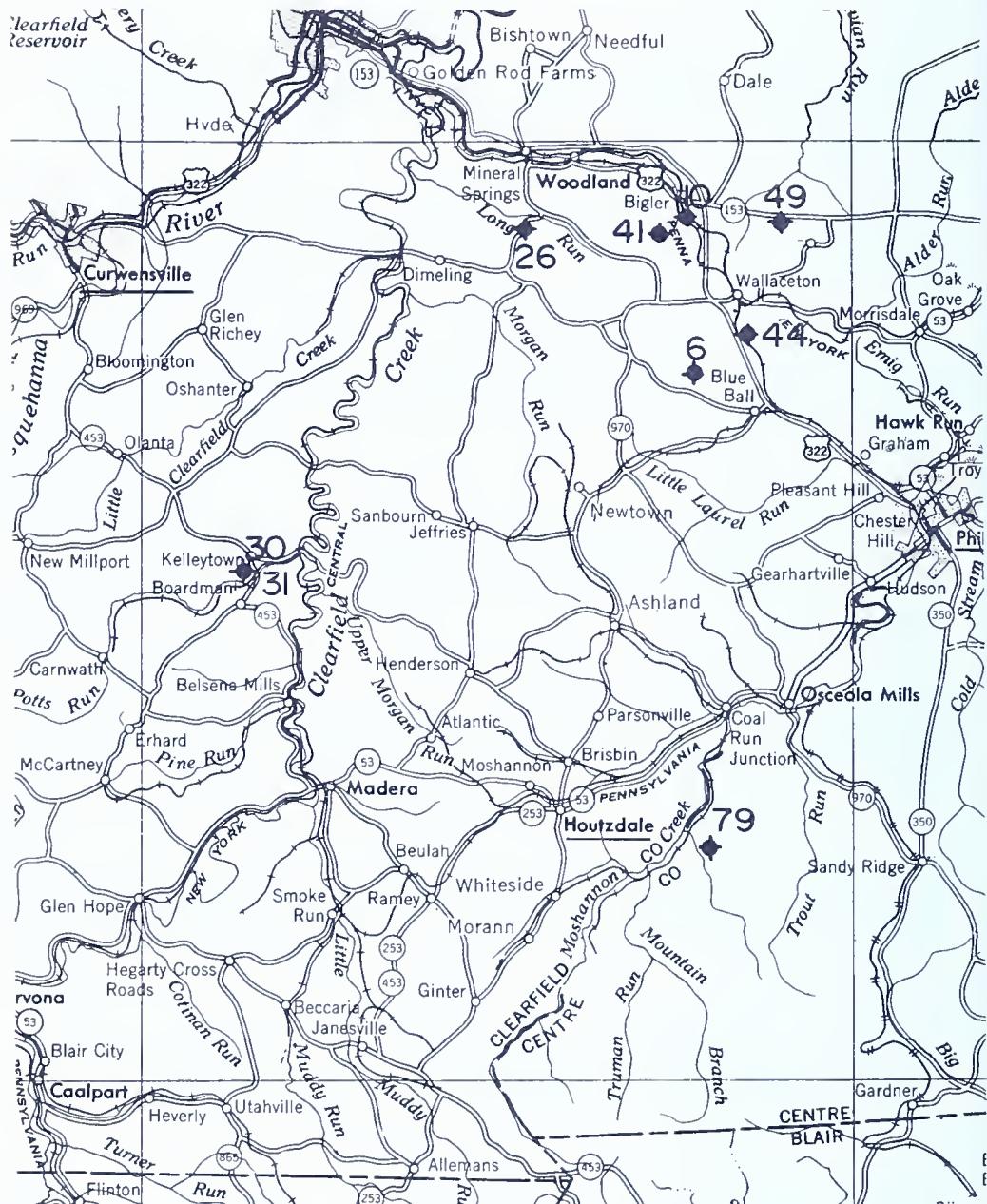


Figure 14. Location of samples collected from the Clarion coals.

The coal was deposited upon an uneven erosion surface, giving rise to the multiple-bedded deposits characteristic of most coals in the Houtzdale quadrangle. Where the interval between the Lower Kittanning and the Mercer is reduced, the Clarion coals may lie 6 to 8 feet above the upper Mercer, separated by a plastic or semi-plastic clay zone (Figure 2).

The coal is usually high in ash and sulfur content, thin, and rarely minable. For this reason, only three samples were collected at the sites

Table 9. Petrographic composition of the Clarion coals.

| Sample No. | Vitrinoids | Exinoids | Micrinoids | Semi-fusinite | Fusinite | Ash | Bed |
|-------------------------|------------|----------|------------|-------------------------------|----------|------|-----------|
| | | | | dark shale and coaly shale | | | Thickness |
| Clarion 3 | | | | | | | |
| 6 | — | — | — | dark shale and coaly shale | — | — | 11" |
| 31 | — | — | — | shaly coal | — | 39.7 | 9 |
| 79 | — | — | — | coaly shale | — | — | 11 |
| Clarion 2 | | | | | | | |
| 6 | 84.8 | 6.0 | 4.0 | — | 5.2 | 9.3 | 18 |
| 26 | 85.8 | 4.0 | 6.2 | 0.3 | 3.7 | 14.0 | 26 |
| 30 | 81.7 | 5.1 | 6.9 | 1.8 | 4.5 | 13.5 | 25 |
| 79# | 81.0 | 4.1 | 6.4 | 1.8 | 6.7 | 8.2 | 32 |
| Average | 83.3 | 4.8 | 5.9 | 1.0 | 5.0 | 9.0 | |
| Clarion 1 | | | | | | | |
| 10 | 84.4 | 3.3 | 5.3 | 1.3 | 5.7 | 5.9 | 20 |
| 41 | 89.2 | 3.5 | 2.0 | 0.5 | 4.8 | 5.1 | 24 |
| 44 | 88.8 | 3.3 | 3.6 | 1.1 | 3.2 | 6.5 | 12 |
| 49 | 84.1 | 2.3 | 4.7 | 2.2 | 6.7 | 6.9 | 16 |
| 79# | 90.4 | 2.0 | 3.9 | 0.7 | 3.0 | 11.2 | 29 |
| Average | 87.4 | 2.9 | 3.9 | 1.1 | 4.7 | 7.1 | |
| Undifferentiated | | | | | | | |
| 79 | 85.5 | 3.1 | 5.2 | 1.3 | 4.9 | 9.7 | 63½* |

partial values * excludes coaly shale of Clarion 3

shown in Figure 15. Table 10 summarizes the petrographic data obtained from these coals. The lower coal contains dull canneloid bands. Numerous megaspores are present in the canneloid shale partings, but in the adjacent coal layers the lack of exinoid concentrations as high as might be anticipated from megascopic observations suggests that these megaspores were highly carbonified.

CHEMICAL CHARACTERISTICS

Proximate and ultimate analyses of mine samples collected by previous writers from the approximate locations shown in Figure 16 are presented in Table 11. These samples represent the coal in place at specified locations within the mine. They are collected in accordance with the standard methods employed by the U.S. Bureau of Mines and the U.S. Geological Survey (Holmes, 1918). As shown in Table 11, the coals are primarily of medium volatile rank, although a few total coal analyses do indicate low-volatile coal.

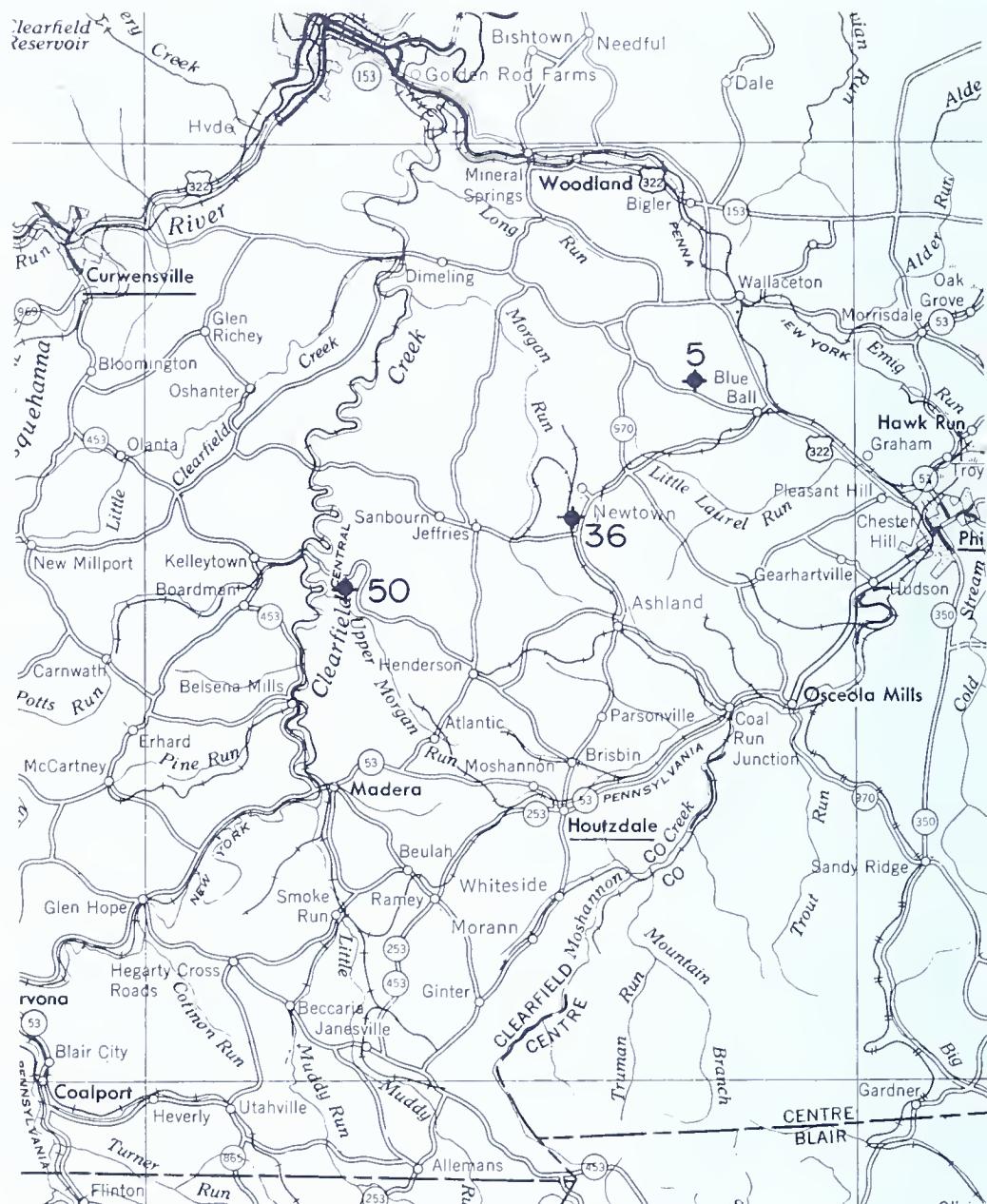


Figure 15. Location of samples collected from the Mercer coals.

The samples are listed in stratigraphic order. Some of the analyses are based upon coals which possibly have been incorrectly identified, especially some of the Lower Kittanning samples. The coal mined around Boardman has long been known to be the Clarion (Brookville) coal, but has been called the "Boardman B". The Potts Run No. 3 Mine, listed as mining Lower Kittanning coal by the U.S. Bureau of Mines (#24 in Figure 16 and in Table 11), is definitely Clarion (Shepps, personal communica-

Table 10. *Petrographic composition of the Mercer coals.*

| <i>Bed</i> | <i>Sample No.</i> | <i>Vitrinoids</i> | <i>Exinoids</i> | <i>Micrinoids</i> | <i>Semi-fusinite</i> | <i>Fusinite</i> | <i>Ash</i> |
|------------|-------------------|-------------------|-----------------|-------------------|----------------------|-----------------|------------|
| upper | 5 | 76.1 | 2.9 | 10.0 | 3.0 | 8.0 | 11.0 |
| lower | 36 | 80.3 | 2.7 | 5.1 | 4.8 | 7.1 | 16.5 |
| lower | 50 | 79.5 | 4.3 | 8.8 | 2.6 | 4.8 | 11.0 |
| | Average | 78.6 | 3.3 | 8.0 | 3.5 | 6.6 | 12.8 |

tion). The writer is not certain to what extent coals from other mines are miscorrelated. Consequently, original identifications of coal used in the earlier reports are preserved in the tables.

Table 12 reports proximate analyses and supplementary data for tipple and delivered samples made by the U.S. Bureau of Mines. These samples indicate quality of the coal produced at the time the coal was sampled, and may contain coal taken from several places within the named mine. These data may be used to supplement the data given in Table 11 and to ascertain the range in quality of coal actually produced in the district.

For further details on sampling and testing methods, the reader is referred to "ASTM Standards on Coal and Coke," published by the American Society for Testing Materials (1959). For additional data on chemical and physical properties of the coals of the area, earlier published reports of the U.S. Bureau of Mines on preparation characteristics (Creutz and others, 1952) and on carbonizing properties (Birge and others, 1963) may be consulted.

CONCLUSIONS

A summary of the petrographic composition of the coals studied in the Houtzdale quadrangle is presented as Table 13. This table shows that most minable coals of the quadrangle contain more than 85 percent vitrinoids, 0.8 to 5.8 percent fusinite and 0.36 to 1.8 percent semi-fusinite, and moderate to low ash percentages. The averages of generally unminable coal beds lack these characteristics. The Upper Kittanning coal is only locally minable for special reasons as mentioned earlier in the detailed treatment.

Only three Allegheny coals studied average less than 85 percent vitrinoids. These are; 1) the Upper Kittanning coal, 2) bed B-2 of the Lower Kittanning, and 3) the Clarion 2 bed. The latter two beds are persistent. When recovered, they are mined along with other coal having higher than 85 percent vitrinoid and the blending of the two coals raises the total vitrinoid values to 85 percent or more. Although the Upper Kittanning sometimes is mined and blended with the underlying Middle

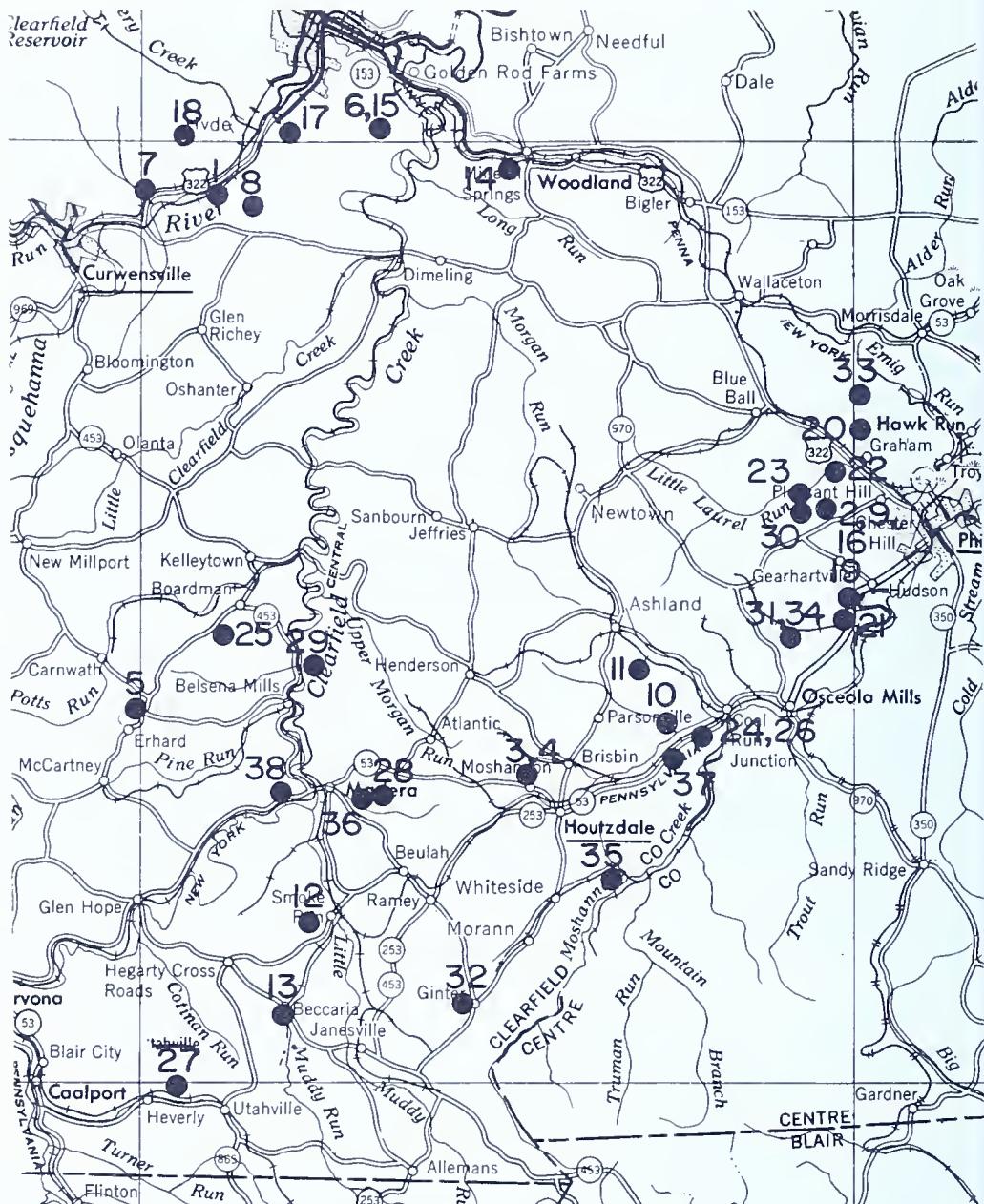


Figure 16. Location of mine samples used for proximate and ultimate analyses.

Kittanning coal, the sporadic distribution and variable petrography of the coal from place to place (Table 5) indicates that caution must be exercised in evaluating the coal.

Coals of the Conemaugh and Pottsville Groups have lower vitrinoïd and higher fusinoïd values as compared to Allegheny coals. Additionally, Conemaugh and Pottsville have a content of high ash. The data suggest that the Conemaugh and Pottsville coals can have only local economic

significance in this area, because low vitrinoid percentages and high ash and fusinoid content make the coal poor for most uses.

The petrography of a given seam may be uniform as shown by the data on the Upper Freeport coal, or it may be extremely variable such as shown for the Lower Kittanning coal. When beds or benches of a particular coal are added or lost, the overall petrography and the chemical properties reflect that change. Composite analyses of a particular coal thus do not show the lateral continuity of layers which have similar petrographic compositions. When the more stratigraphically complex coals such as Lower Kittanning are studied layer by layer, the lateral variability in petrography determine the lack of uniform chemical properties.

Individual coal layers were shown to have laterally consistent properties in the foregoing presentation. In the opinion of the writer, this consistency represents the sum of environmental factors operative during the time of deposition of the organic matter making up the bench, as modified by regional metamorphism since the accumulation of the coal. For example, one bench may be deposited during a period characterized by extremely wet conditions; another bench during a drier period. Wetter conditions are conducive to preserving plant tissues chemically different from those preserved under long term drier conditions. Widespread stability in petrography of these benches may also indicate that different types of the coal-forming plants were more prevalent as a result of wetter or drier conditions and the different types are subsequently preferentially preserved in distinctive benches.

Lateral discontinuity and absence of bottom benches or beds of the coal is interpreted to indicate local topographic relief on the surface upon which the coal was deposited (Koppe 1963). The petrographic character of the Upper Freeport coal indicated that it was apparently only slightly affected by the local topography. The discontinuous lower layers of the Lower Freeport coal, on the other hand, indicates that the pre-coal topography may have controlled location of deposition of the lower layers (Figure 7). Local swamp development (e.g. Sample 85-C-37 discussed in the section on the Middle Kittanning coal) prior to covering of the area by the major coal swamp may add benches at the base of the coal thus changing the total petrography and chemical properties of the seam.

Sufficient petrographic differences were reported between coals of this quadrangle to permit rather close correlations and to determine the affinities to the major coals of apparent "local" or "stray" coals often found in the geological log of the strata.

HOOTZDALE COAL PETROGRAPHY

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples

| Coal Location of mine samples (see Fig. 16) | Location | Mine | Location in Mine | PROXIMATE PERCENT | | | | | | ULTIMATE PERCENT | | | | Reference Sources | | |
|--|-----------------------------------|--|------------------------------|-------------------|----------------------|----------|--------------------|-----------------|----------|------------------|--------|------------------|------------------------|-------------------|------------|--------|
| | | | | Sample Number | Laboratory number | Moisture | Volatile matter | Fixed carbon | Hydrogen | Nitrogen | Ash | Per cent loss | Temp. for softening | | | |
| 1 Upper Freeport of Clearfield | 3 miles west of Clearfield | Schickling | Face of main heading | 1 | 75,672 | 2.8 | 24.9 | 65.8 | 6.7 | 0.7 | 1.6 | 14,140 | 2,550 | T.P. 590, p. 174 | | |
| 2 Upper Freeport of Philipsburg | 2½ miles northwest Conquest | Face of main entry | 1 | 75,733 | 4.2 | 23.9 | 63.4 | 8.5 | 1.0 | 1.6 | 14,530 | 14,270 | T.P. 590, p. 180 | | | |
| Upper Freeport of Brisbin | 1 mile southwest Lenore No. 1 & 2 | Face of left heading, main heading | 1 | 12,046 | 3.0 | 21.6 | 67.8 | 7.8 | 0.8 | 1.9 | 14,020 | 2,640 | M6, Pt. 4, p. 65 | | | |
| Freeport Upper of Brisbin | 1 mile southwest Lenore No. 1 & 2 | Face of 2 left heading, No. 2 Drift | 1 | 12,044 | 3.1 | 21.8 | 66.1 | 9.0 | 1.1 | 2.0 | 13,840 | 2,450 | M6, Pt. 4, p. 65 | | | |
| 3 Upper Freeport of Brisbin | 1 mile southwest Lenore No. 1 & 2 | Composite of 12,044 & 12,046 | 1 | 12,047 | 3.1 | 21.5 | 67.2 | 8.2 | 0.9 | 4.8 | 78.5 | 1.2 | 8.4 | M6, Pt. 4, p. 65 | | |
| 4 Upper Freeport of Brisbin | 1 mile southwest Lenore No. 2 | Face 2 left heading No. 2 Drift | 1 | 12,045 | 2.8 | 21.8 | 67.9 | 7.5 | 0.9 | 4.9 | 79.7 | 1.3 | 5.7 | M6, Pt. 4, p. 65 | | |
| Lower Freeport | Carnwath No. 1 | 7 room right entry | 1 | 20,342 | 3.0 | 24.3 | 85.0 | 7.7 | 1.8 | 1.0 | 51.1 | 88.9 | 1.4 | 3.3 | 14,600 | |
| Lower Freeport | Carnwath No. 1 | 2 left entry, 1 left entry | 1 | 20,343 | 3.3 | 23.9 | 66.7 | 6.1 | 1.4 | 1.0 | 51.1 | 88.9 | 1.5 | 3.5 | 15,220 | |
| 5 Lower Freeport | Carnwath No. 1 | Composite of 20,342 & 20,343 | 1 | 20,346 | 3.1 | 24.5 | 65.8 | 8.8 | 1.5 | 4.8 | 82.2 | 1.5 | 5.8 | 2.5 | 14,140 | |
| 6 Lower Freeport of Clearfield | 2½ miles southwest Eagle | 1 right heading, 2 right heading | 1 | 75,742 | 3.2 | 22.4 | 66.5 | 7.9 | 2.5 | 1.6 | 51.1 | 88.4 | 1.6 | 3.3 | 14,540 | |
| Lower Freeport of Clearfield | 3 miles west of Clearfield | Cassidy No. 1 heading | 1 | 75,620 | 2.7 | 22.7 | 69.0 | 5.6 | 0.8 | 1.9 | 14,340 | 2,850 | T.P. 590, p. 174 | | | |
| Lower Freeport of Clearfield | 3 miles west of Clearfield | Cassidy No. 1 | Face of 1 left heading | 1 | 75,621 | 2.4 | 23.7 | 68.8 | 5.1 | 1.0 | 1.8 | 14,490 | 2,740 | T.P. 590, p. 174 | | |
| 7 Lower Freeport of Clearfield | 3 miles west of Clearfield | Cassidy No. 1 | Composite of 75,620 & 75,621 | 1 | 75,622 | 2.8 | 23.0 | 69.0 | 5.4 | 1.0 | 4.9 | 81.5 | 1.5 | 5.7 | 1.8 | 14,550 |
| 8 Lower Freeport of Clearfield | 3 miles west Wiley | Face of main heading | 1 | 75,873 | 2.8 | 24.7 | 65.2 | 7.3 | 1.4 | 1.0 | 50.0 | 83.7 | 3.4 | 14,830 | 15,690 | |
| 9 Lower Freeport of Philipsburg | 2½ miles northwest Conquest | Face of main heading | 1 | 75,732 | 3.8 | 23.3 | 87.8 | 5.3 | 0.9 | 1.6 | 1.6 | 3.8 | 3.8 | 14,500 | 14,760 | |
| 10 Lower Freeport of Philipsburg | ½ mile north of Moshannon | Pillars of a small mine, 500 ft., in entry, close to Big Fault | 1 | 8,488 | 2.9 | 21.5 | 72.0 | 4.6 | 0.8 | 5.0 | 82.8 | 1.4 | 5.4 | 2.1 | 14,510 | |
| | | | 2 | | | 21.0 | 73.8 | 4.7 | 0.8 | 4.8 | 85.3 | 1.4 | 3.0 | 14,850 | M 8, p. 71 | |
| | | | 3 | | | 22.5 | 77.5 | 0.8 | 5.1 | 89.5 | 1.5 | 3.1 | 15,699 | | | |

TABLE 11

| Coal | Location | Mine | Location in Mine | PROXIMATE PERCENT | | | | | | ULTIMATE PERCENT | | | | | | Reference Sources | | |
|-------------------|--------------------------------|---|---|--|-------------------|----------|-----------------|--------------|------|------------------|----------|--------|----------|--------|--------------|-------------------|-----------------------|------------|
| | | | | Sample Condition | Laboratory Number | Moisture | Volatile Matter | Fixed Carbon | Ash | Sulfur | Hydrogen | Carbon | Nitrogen | Oxygen | Air-dry Loss | B.T.U. | | |
| Lower Freepoint | 3 miles west of Oscoda Mills | Fairmount | Face of 5 room, 2 left heading | 1 | W17,010 | 3.1 | 21.0 | 69.7 | 6.2 | 1.6 | | | | | 14,150 | M 8, p. 72 | | |
| Lower Freepoint | 3 miles west of Oscoda Mills | Fairmount | Face of 14 room, 8 right heading | 1 | W17,012 | 2.4 | 22.5 | 68.8 | 6.3 | 1.0 | | | | | 14,340 | M 6, p. 72 | | |
| 11 | Lower Freepoint | 3 miles west of Oscoda Mills | Fairmount No. 2 | Composite of W17,010 & W17,012 | 1 | 11,711 | 1.8 | | 6.4 | 1.3 | 4.7 | 81.7 | 1.3 | 4.8 | | | M 8, p. 72 | |
| 12 | Lower Freepoint | ½ mile west of Smoke Run | Eureka No. 22 | Face of 1 west entry, main heading 2,600 ft. from mine mouth, lower split of bed | 1 | 8,489 | 3.2 | 21.0 | 69.3 | 6.5 | 0.7 | 4.9 | 79.9 | 1.3 | 8.7 | 2.2 | 14,060 | M 0, p. 73 |
| 13 | Lower Freepoint | Buccana | Glenmar No. 1 | Drift | Coal | 572 | 2.3 | 23.9 | 66.6 | 7.2 | 1.8 | 4.8 | 80.0 | 1.5 | 4.9 | 15,340 | 2,520 R.L. 6261, p. 9 | |
| 14 | Upper Kittanning | ½ miles south of Woodland | Plane | Face of 1 right entry, 1 right heading | 1 | 8,486 | 3.2 | 23.5 | 65.8 | 7.5 | 3.8 | 4.9 | 77.7 | 1.2 | 4.9 | 2.6 | 13,940 | M 6, p. 74 |
| Middle Kittanning | 2½ miles southwest Eagle | Eagle | 1 room, 1 right heading | 1 | 75,739 | 2.6 | 21.0 | 65.0 | 11.4 | 2.8 | | | | | | | T.P. 590, p. 174 | |
| Middle Kittanning | 2½ miles southwest Eagle | Eagle | Face of 1 right heading | 1 | 75,740 | 2.1 | 21.0 | 65.4 | 11.5 | 3.4 | | | | | | | T.P. 590, p. 174 | |
| 15 | Middle Kittanning | 2½ miles southwest Eagle | Face of 1 right heading | 1 | 75,741 | 2.4 | 21.0 | 65.2 | 11.4 | 3.1 | 4.6 | 75.4 | 1.3 | 4.2 | 1.7 | 13,360 | T.P. 590, p. 174 | |
| 16 | Middle Kittanning | 2½ miles northwest Conquest | Composite of 75,739 & 75,740 | 1 | 75,741 | 2.4 | 21.6 | 66.7 | 11.7 | 3.2 | 4.5 | 77.3 | 1.3 | 2.0 | 1.7 | 13,690 | T.P. 590, p. 174 | |
| 17 | Middle Kittanning | 1½ miles west MacTavish & Bailey Prospect | Face of 1 left heading | 1 | 75,731 | 3.9 | 21.1 | 69.0 | 6.0 | 2.3 | | | | | | | T.P. 590, p. 174 | |
| Middle Kittanning | 1½ miles west Another Prospect | Conquest | 50 ft. in entry | 1 | 75,652 | 3.0 | 23.3 | 69.1 | 4.6 | 1.1 | | | | | | | T.P. 590, p. 174 | |
| Middle Kittanning | 1½ miles west Another Prospect | Eagle | Face of 1 room, 1 right heading, 500 ft. in entry | 1 | 75,739 | 2.6 | 21.0 | 65.0 | 11.4 | 2.8 | | | | | | | T.P. 590, p. 174 | |
| Middle Kittanning | 2½ miles southwest Eagle | Eagle | Face of 1 right heading, 500 ft. in entry | 1 | 75,740 | 2.1 | 21.0 | 65.4 | 11.5 | 3.4 | | | | | | | T.P. 590, p. 174 | |
| 18 | Middle Kittanning | 2½ miles southwest Eagle | Face of 1 right heading, 500 ft. in entry | 1 | 75,741 | 2.4 | 21.0 | 65.2 | 11.4 | 3.1 | 4.6 | 75.4 | 1.3 | 4.2 | 1.7 | 13,360 | M 8, p. 68 | |
| Middle Kittanning | 2½ miles southwest Eagle | Eagle | Composite of 75,739 & 75,740 | 1 | 75,741 | 2.4 | 21.6 | 66.7 | 11.7 | 3.2 | 4.5 | 77.3 | 1.3 | 2.0 | 1.7 | 13,690 | M 8, p. 68 | |
| Middle Kittanning | 2½ miles southwest Eagle | Eagle | Face of 1 room, 1 right heading, 500 ft. in entry | 1 | 75,739 | 2.6 | 21.0 | 65.0 | 11.4 | 2.8 | | | | | | | T.P. 590, p. 174 | |

HOOTZDALE COAL PETROGRAPHY

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples (Contd.)

| Coal (see Fig. 16) | Location | Mine | Location in Mine | Sample Condition | Laboratory | PROXIMATE PERCENT | | | ULTIMATE PERCENT | | | Reference Sources | | |
|--|---|--|---------------------|---------------------|------------|-------------------|--------------------|-----------------|------------------|--------|--------|-------------------|------------------------------------|------------------------------|
| | | | | | | Moisture | Volatile Matter | Fried Carbon | Hydrogen | Carbon | Oxygen | Ash | | |
| 19 Middle Kittingning Gearhardtville | 1 mile south of Karpert No. 1 | C | Coal | 878 | 2.8 | 20.7 | 66.6 | 9.9 | 3.5 | 4.8 | 76.2 | 1.3 | 4.3 | 15.280 2.150 R.I. 6261, p. 9 |
| 20 Middle Kittingning $\frac{1}{2}$ mile northwest of Graham | End of 4 straight headings, 8,000 ft. from mine mouth | Gulen | No. 1 | 8,484 | 2.7 | 20.0 | 67.1 | 10.2 | 2.0 | 4.8 | 76.9 | 1.3 | 4.8 | 1.9 13.610 13.970 M 8, p. 67 |
| 21 Middle Kittingning Gearhardtville | 1 mile south of C. & G. No. 1 | C | Coal | 879 | 2.3 | 21.9 | 85.7 | 10.1 | 3.7 | 4.7 | 76.4 | 1.3 | 3.8 | 15.330 2.150 R.I. 6261, p. 9 |
| 22 Lower Kittingning of Philipsburg | 2½ miles northwest Roden | Face of 2 left heading | No. 1 | 75,735 | 2.5 | 21.9 | 81.8 | 13.8 | 4.0 | | | 1.7 | 12.800 2.360 T.P. 590, p. 180 | |
| Lower Kittingning of Philipsburg | 2½ miles northwest Alden No. 1 | Main heading, last left cross entry | 1 | 90,068 | 2.4 | 25.5 | 58.5 | 13.8 | 3.3 | | | 1.9 | 12.940 2.450 T.P. 590, p. 180 | |
| Lower Kittingning of Philipsburg | 2½ miles northwest Alden No. 1 | Last left heading, Back heading | 1 | 90,067 | 2.2 | 23.0 | 62.7 | 12.1 | 2.8 | | | 1.8 | 13.240 2.880 T.P. 590, p. 180 | |
| Lower Kittingning of Philipsburg | 2½ miles northwest Alden No. 1 | Last room, Wilson Dunn heading | 1 | 90,068 | 2.5 | 24.0 | 59.2 | 14.3 | 3.8 | | | 2.0 | 12.780 2.510 T.P. 590, p. 180 | |
| 23 Lower Kittingning of Philipsburg | 2½ miles northwest Alden No. 1 | Composite of 90,066 to 90,068 | 1 | 90,069 | 2.3 | 24.1 | 60.1 | 13.5 | 3.2 | 4.5 | 72.5 | 1.2 | 5.1 12.950 13.250 T.P. 590, p. 180 | |
| 24 Lower Kittingning of Coal Run | 1 mile southwest Smith-Kittanning No. 3 | Potts Run | Coal | 578 | 3.8 | 21.0 | 60.1 | 15.3 | 5.2 | 4.5 | 89.3 | 1.2 | 4.5 | 15.030 2.280 R.I. 6261, p. 9 |
| Lower Kittingning | (near Boardman) Potts Run | Face of 3 right entry, main entry 1,400 ft. southwest of mine mouth | 1 | 12,093 | 2.7 | 20.8 | 67.8 | 8.7 | 1.6 | | | 2.0 | 13.900 2.530 M 8, p. 65 | |
| Lower Kittingning | (near Boardman) Potts Run | On ribs 10 ft. from face of 4 right entry, main entry 1,700 ft. southwest of mine mouth. | 1 | 12,094 | 2.4 | 20.8 | 68.1 | 8.7 | 1.5 | | | 1.7 | 13.950 3,680 M 8, p. 85 | |
| Lower Kittingning | (near Boardman) Potts Run | Face of main heading, 2,000 ft. north of mine mouth | 1 | 12,098 | 3.4 | 20.5 | 87.7 | 8.4 | 1.1 | | | 2.1 | 13.890 3,010 M 8, p. 85 | |
| Lower Kittingning | (near Boardman) Potts Run | Face of 3 left entry, main entry, 1,680 ft. northeast of mine mouth | 1 | 12,097 | 3.0 | 21.2 | 87.0 | 8.8 | 1.4 | | | 2.3 | 13.860 3,010 M 8, p. 85 | |
| 25 Lower Kittingning | (near Boardman) Potts Run | Composite of 12,093 & 12,097 | 1 | 12,098 | 3.0 | 21.3 | 86.9 | 8.8 | 1.4 | 4.7 | 78.5 | 1.2 | 5.4 13.900 14.320 M 8, p. 85 | |
| | | | 2 | 21.9 | 89.0 | 9.1 | 1.4 | 4.5 | 80.9 | 1.2 | 2.9 | 3.1 | 15,760 | |
| | | | 3 | 24.1 | 75.9 | 1.3 | 5.0 | 89.0 | 1.4 | | | | | |

TABLE 11

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples (Cont'd.)

| Location of mine (see Mine Samples Table) | Coal | Location | Mine | Location in Mine | PROXIMATE PERCENT | | | | | | ULTIMATE PERCENT | | | | | | Reference Sources | |
|--|------------------|---|------------------|---|-------------------|--------|--------|----------|-------|--------|------------------|--------|----------|--------|--------|--------|-------------------|-----------------|
| | | | | | Sample | | | Miner | | | Hydrogen | | | Carbon | | | | |
| | | | | | Condensate | Number | Mater. | Volatile | Fried | Carbon | Sulfur | Oxygen | Hydrogen | Carbon | Sulfur | Oxygen | | |
| 26 | Lower Kittanning | 1 mile southwest of Coal Run | Smith-Kittanning | Face of 2 right entry, No. 19 main heading | Coal | 577 | 2.8 | 21.8 | 68.5 | 8.9 | 1.4 | 4.8 | 76.0 | 1.4 | 5.5 | 15.290 | 2.700 | R.I. 6261, p. 9 |
| | Lower Kittanning | 2½ miles east of Coalport | Irvona | Face of 10 face entry, 500 ft. off 5 left entry | W17.056 | 3.0 | 21.0 | 68.0 | 6.0 | 0.7 | | | | | | | 13.980 | M 6, p. 67 |
| | Lower Kittanning | 2½ miles east of Coalport | Irvona | Composite of W17.056 & W17.057 | W17.057 | 2.0 | 21.5 | 88.0 | 8.5 | 0.6 | | | | | | | 14.080 | M 6, p. 67 |
| 27 | Lower Kittanning | 2½ miles east of Coalport | Irvona | Face of 4 south entry, 5 right entry | W17.057 | 1.5 | 11.702 | 8.1 | 0.8 | 4.7 | 80.9 | 1.2 | 4.3 | | | | | M 8, p. 67 |
| | Lower Kittanning | 1 mile east of Madera | Morgan Run | Face of 4 south entry, 5 right entry | W20.402 | 1.5 | 18.6 | 69.4 | 70.4 | 2.8 | | | | | | | | M 8, p. 69 |
| | Lower Kittanning | 2 miles north of Madera | Bucher | Face of 9 left entry, 1 cross heading, 3,400 ft., northeast of mine mouth | W20.435 | 2.3 | 18.7 | 68.7 | 70.5 | 10.5 | 1.0 | | | | | | 13.820 | M 8, p. 69 |
| | Lower Kittanning | 2 miles north of Madera | Bucher | Face of 8 right heading, 3,800 ft., northeast of main heading | W20.436 | 2.1 | 20.0 | 68.9 | 9.0 | 1.5 | | | | | | | 14.040 | M 6, p. 69 |
| | Lower Kittanning | 2 miles north of Madera | Bucher | Face of 10 right heading, 4,500 ft., northeast of mine mouth | W20.437 | 2.4 | 19.9 | 68.2 | 9.5 | 1.2 | | | | | | | 13.890 | M 6, p. 69 |
| | Lower Kittanning | 2 miles north of Madera | Bucher | Face of 7 left heading, 3,000 ft., northeast of mine mouth | W20.438 | 2.3 | 19.5 | 70.2 | 6.0 | 1.2 | | | | | | | 14.110 | M 6, p. 69 |
| | Lower Kittanning | 2 miles north of Madera | Bucher | Face of 7 right heading, 3,200 ft., northeast of mine mouth | W20.439 | 2.3 | 20.4 | 69.0 | 8.3 | 1.2 | | | | | | | 13.690 | M 6, p. 69 |
| 29 | Lower Kittanning | 2 miles west of Philipsburg (Centre County) | Guion | Face of 1 right heading, 2 right entry, 4,000 ft. from mine mouth | W20.369 | 2.0 | 20.0 | 69.9 | 8.1 | 1.1 | | | | | | | 14.090 | M 6, p. 72 |
| | Lower Kittanning | 2 miles west of Philipsburg (Centre County) | Guion | Face of 2 right heading, 4,000 ft. from mine mouth | W20.370 | 2.0 | 21.5 | 89.2 | 7.3 | 1.0 | | | | | | | 14.230 | M 6, p. 72 |
| | Lower Kittanning | 2 miles west of Philipsburg (Centre County) | Guion | Back heading, 1 right entry, 2,500 ft. from mine mouth | W20.371 | 2.9 | 16.4 | 69.1 | 9.6 | 2.2 | | | | | | | 13.660 | M 6, p. 72 |

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples (Contd.)

TABLE 11

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples (Contd.)

| Coal Location (see Fig. 16) | Location | Mine | Location in Mine | Sample Condition | PROXIMATE PERCENT | | | | | | ULTIMATE PERCENT | | | | Reference Sources | |
|-----------------------------------|---|---|--|---------------------|----------------------|--------------------|-----------------|-------|--------|----------|------------------|-------------------|-----------------|--------------------|--------------------------------|---------------------------------|
| | | | | | Laboratory Number | Volatile Matter | Fixed Carbon | Ash | Sulfur | Hydrogen | Nitrogen | Carbon Dioxide | Air-dry Loss | Dry, P. T.C. | A.S.T.M. Softening Point | |
| Lower Kittanning | 3½ miles southwest of Philipsburg (Centre County) | Acme No. 2 | Pillar in room 1 off left entry 3 off lucky 2½ entry, about ¾ mile northeast of entrance | 1 | 10.261 | 3.12 | 20.17 | 89.17 | 7.54 | 1.97 | | | | 14,002 | U.S.B.M. Bull. 22 p. 167 | |
| 34 | Lower Kittanning | 3½ miles southwest of Philipsburg (Centre County) | Composite of 10,260 & 10,261 | 1 | 10.265 | 2.80 | 20.21 | 69.60 | 7.39 | 1.87 | 5.00 | 79.86 | 1.34 | 4.72 | 2.1 | 14,080 U.S.B.M. Bull. 22 p. 167 |
| Brookville | 2 miles south of Houtzdale | Mountain Branch | Face of 2 left heading | 1 | W46.818 | 0.8 | 23.3 | 84.9 | 11.0 | 3.5 | | | | 13,630 | T.P. 590, p. 170 | |
| Brookville | 2 miles south of Houtzdale | Mountain Branch | Face of main heading | 1 | W46.817 | 5.0 | 21.0 | 65.3 | 6.1 | 2.8 | | | | 13,260 | T.P. 590, p. 178 | |
| Brookville | 2 miles south of Houtzdale | Mountain Branch | 1 dip heading, 1 left heading | 1 | W46.818 | 1.9 | 23.6 | 81.9 | 12.8 | 3.3 | | | | 13,160 | T.P. 590, p. 176 | |
| Brookville | 2 miles south of Houtzdale | Mountain Branch | Face of 3 left heading | 1 | W46.819 | 2.1 | 22.5 | 84.0 | 11.4 | 3.9 | | | | 13,290 | T.P. 590, p. 176 | |
| Brookville | 2 miles south of Houtzdale | Mountain Branch | Last room, 1 left heading | 1 | W46.820 | 1.9 | 23.1 | 62.6 | 12.2 | 4.1 | | | | 13,280 | T.P. 590, p. 176 | |
| 35 | Brookville | 2 miles south of Houtzdale | Composite of W46.816 to W46.820 | 1 | 19.615 | 2.3 | 22.8 | 63.9 | 11.0 | 3.6 | 4.4 | 75.2 | 1.1 | 4.7 | 13,360 T.P. 590, p. 178 | |
| 36 | Brookville (near Madera) | Sylvania No. 1 | Face of 1 right entry, 5,000 ft from mine mouth | 1 | 8.490 | 2.4 | 20.5 | 70.8 | 6.3 | 1.7 | 4.9 | 60.9 | 1.4 | 4.9 | 1.6 | 14,330 M. 8, p. 89 |
| 37 | Brookville | ½ mile southeast of Moshannon No. 2 | Face of 2 left entry, 1 main entry, 1,000 ft. from mine mouth | 1 | 8.480 | 2.8 | 20.7 | 87.5 | 8.9 | 2.9 | 5.0 | 77.6 | 1.0 | 4.6 | 1.9 | 14,680 15,690 |
| 38 | Brookville | 1 mile west of Madera | Marks No. 1 | 1 | 8.480 | 3.3 | 20.1 | 65.5 | 11.1 | 2.5 | 4.8 | 75.2 | 1.2 | 5.2 | 15,140 2,300 R.I. 6281, p. 9 | |

Sample Condition: 1 - As received; 2 - Dry Basis; 3 - Moisture and Ash free,

• No. 25 actually Clarion (Brookville coal)

Table 12. Proximate Analyses of Coal as Shipped and Delivered

| Location Near | Mine | Size of Coal | Proximate Analysis | | | | | | B. T. U. Per Pound | | | No. of Analyses | Ash-fusion Temp. | Softening Point | Ash-fusion Temp. | Reference Source |
|---------------------|------------------------------|---------------------|--------------------|----------|-------|---------|--------|--------|--------------------|--------|-------|-----------------|---------------------|--------------------|---------------------|---------------------|
| | | | Moisture | Volatile | Fixed | Carboon | Sulfur | Ash | Dry | As | Re-d. | | | | | |
| Upper Freeport Coal | | | | | | | | | | | | | | | | |
| Houtzdale | West End | ROM | 3.0 | 22.8 | 70.0 | 7.2 | 0.8 | 13.990 | 14,420 | 15.540 | 1 | 2570 | 1 | T.P. 590 | | |
| Houtzdale | Moran Slope | ROM | 2.5 | 24.6 | 63.9 | 11.5 | 2.0 | 13,470 | 13,810 | 15,610 | 1 | 2370 | 1 | T.P. 590 | | |
| Osecola Mills | Center | ROM | 3.4 | 24.5 | 63.5 | 10.2 | 2.2 | 13,450 | 13,920 | 15,500 | 1 | 2300 | 1 | T.P. 590 | | |
| Osecola Mills | Superior #1 | 2" lump | 2.1 | 24.5 | 63.0 | 12.5 | 3.1 | 13,310 | 13,600 | 15,540 | 1 | 2240 | 1 | T.P. 645 | | |
| Osecola Mills | Superior #1 | 0 x 2" | 2.7 | 24.4 | 64.5 | 11.1 | 2.7 | 13,480 | 13,850 | 15,580 | 1 | 2260 | 1 | T.P. 645 | | |
| Osecola Mills | Superior #1* | ROM | 2.6 | 24.8 | 65.6 | 9.6 | 3.2 | 13,720 | 14,090 | 15,590 | 2 | ..... | .. | T.P. 645 | | |
| Osecola Mills | Superior #1* | ROM | 2.8 | 24.9 | 66.0 | 9.1 | 2.1 | 13,720 | 14,120 | 15,530 | 2 | ..... | .. | T.P. 645 | | |
| Osecola Mills | Superior #1* | 2" Lump | 3.0 | 24.8 | 65.2 | 10.0 | 2.5 | 13,610 | 14,030 | 15,590 | 4 | ..... | .. | T.P. 645 | | |
| Osecola Mills | Superior #1* | 2" x 5" | 3.1 | 23.6 | 66.7 | 9.7 | 1.7 | 13,630 | 14,070 | 15,580 | 3 | ..... | .. | T.P. 645 | | |
| Osecola Mills | Nut & Slack | 2.2 | 24.5 | 64.8 | 10.7 | 2.4 | 13,590 | 13,900 | 15,570 | 7 | 2310 | 1 | T.P. 645 | | | |
| Morann | * Mined with Lower Freeport | | | | | | | | | | | | | | | |
| Lower Freeport Coal | | | | | | | | | | | | | | | | |
| Beccaria | Glenmar #1 | ROM | 1.7 | 23.7 | 68.1 | 8.8 | 1.0 | 13,940 | 14,180 | 15,550 | 7 | ..... | .. | M 6 | | |
| Beccaria | Glenmar #1 | ROM | 1.4 | 24.2 | 68.7 | 7.1 | 1.2 | 14,280 | 14,480 | 15,590 | 1 | 2620 | 1 | M 6 | | |
| Beccaria | Leland #10 | ROM | 2.4 | 23.2 | 69.1 | 7.7 | 0.7 | 14,070 | 14,400 | 15,610 | 1 | 2940 | 1 | M 6 | | |
| Beccaria | Leland #10 | $\frac{3}{4}$ x 2 | 2.2 | 23.8 | 68.4 | 7.8 | 0.7 | 14,030 | 14,340 | 15,560 | 1 | 2910- | 1 | T.P. 645 | | |
| Beccaria | Leland #10 | 0 x 1 $\frac{1}{4}$ | 2.7 | 23.9 | 68.7 | 7.4 | 0.7 | 14,020 | 14,410 | 15,570 | 1 | 2910- | 1 | T.P. 645 | | |
| Beccaria | Leland #10 | 0 x $\frac{3}{4}$ | 2.8 | 24.0 | 68.7 | 7.3 | 0.7 | 14,060 | 14,460 | 15,590 | 1 | 2910- | 1 | T.P. 645 | | |
| Beccaria | Houtzdale Coalmont-Moshammon | ROM | 5.4 | 21.3 | 64.7 | 14.0 | 1.1 | 12,370 | 13,080 | 15,210 | 12 | ..... | .. | M 6 | | |
| Osecola Mills | Daywood #1 | ROM | 2.2 | 24.8 | 68.3 | 6.9 | 1.9 | 14,220 | 14,530 | 15,610 | 1 | 2390 | 1 | T.P. 590 | | |
| Osecola Mills | Daywood #1 | ROM | 1.9 | 24.0 | 68.5 | 9.5 | 2.0 | 14,050 | 14,050 | 15,520 | 3 | ..... | .. | T.P. 590 | | |
| Ramey | Bulah #1 | ROM | 3.1 | 22.9 | 67.5 | 9.6 | 1.8 | 13,670 | 14,110 | 15,610 | 1 | 2390 | 1 | T.P. 590 | | |
| Ramey | Bulah #1 | 1" nut & slack | 4.2 | 22.8 | 69.0 | 8.2 | 1.5 | 13,770 | 14,370 | 15,650 | 1 | 2550 | 1 | T.P. 590 | | |
| Ramey | Bulah #4 | ROM | 3.6 | 16.4 | 78.1 | 5.5 | 0.6 | 14,280 | 14,810 | 15,670 | 38 | ..... | .. | M 6 | | |
| Ramey | King | ROM | 4.0 | 25.3 | 66.6 | 8.1 | 2.3 | 13,780 | 14,350 | 15,610 | 2 | 2200 | 2 | T.P. 590 | | |
| Ramey | Mt. Vernon #10 | ROM | 2.6 | 24.2 | 66.7 | 9.1 | 1.3 | 13,570 | 13,930 | 15,320 | 2 | ..... | .. | T.P. 590 | | |
| Ramey | Vulcan #2 | ROM | 2.6 | 24.8 | 66.5 | 8.7 | 1.7 | 13,730 | 14,100 | 15,440 | 47 | ..... | .. | M 6 | | |

TABLE 12

Table 12. Proximate Analyses of Coal as Shipped and Delivered (Contd.)

| Location Near Mine | Size of Coal | ROM | 2.0 | Upper Kittanning Coal | | | Middle Kittanning Coal | | | Lower Kittanning Coal | | |
|--------------------------|-----------------|--------------------|-----|-----------------------|-----------------|------|------------------------|---------------|-------------|-------------------------|--------------------|--------------------|
| | | | | Proximate Analysis | | | B. T. U. Per Pound | | | Ash-free Dry Coal | | |
| | | | | Volatile Matter | Fixed Carbon | Ash | Sulfur | As Free'd. | As Sulf. | Moisture | No. of Analyses | Temp. Softening |
| Osceola Mills | Reading #2 | ROM | 2.0 | 21.7 | 67.0 | 11.3 | 3.7 | 13,510 | 13,780 | 15,540 | 1 | 2310 |
| Houtzdale | Imperial #3 | ROM | 2.4 | 21.4 | 68.5 | 9.8 | 1.8 | 13,700 | 14,040 | 15,570 | 39 | ..... |
| Houtzdale | Imperial #3 | 1 1/4" lump | 2.4 | 20.9 | 69.7 | 9.4 | 1.7 | 13,810 | 14,150 | 15,620 | 8 | T.P. 645 |
| Houtzdale | Imperial #3 | 1" lump | 2.4 | 19.7 | 68.1 | 12.2 | 0.9 | 13,420 | 13,750 | 15,650 | 1 | T.P. 645 |
| Houtzdale | Imperial #3 | 1 x 6 | 2.3 | 21.0 | 69.1 | 9.9 | 2.1 | 13,720 | 14,040 | 15,580 | 3 | ..... |
| Houtzdale | Imperial #3 | 1 x 6 | 1.2 | 21.1 | 68.9 | 10.0 | 3.8 | 13,850 | 14,020 | 15,580 | 1 | T.P. 645 |
| Houtzdale | Imperial #3 | 1 1/2 x 5" | 2.4 | 20.9 | 67.7 | 11.4 | 2.7 | 13,450 | 13,790 | 15,560 | 1 | ..... |
| Houtzdale | Imperial #3 | 2 x 3" | 3.1 | 20.6 | 69.2 | 10.2 | 2.7 | 13,600 | 14,040 | 15,630 | 1 | ..... |
| Houtzdale | Imperial #3 | 1 1/4 x 3" | 3.1 | 20.1 | 69.9 | 10.0 | 1.8 | 13,630 | 14,070 | 15,640 | 1 | ..... |
| Houtzdale | Imperial #3 | 3/4 x 2 | 0.7 | 21.0 | 69.6 | 9.4 | 1.5 | 14,100 | 14,200 | 15,670 | 2 | 2650 |
| Houtzdale | Imperial #3 | 1/4 x 1 | 2.3 | 20.3 | 69.3 | 10.4 | 1.7 | 13,710 | 14,030 | 15,660 | 1 | 2590 |
| Houtzdale | Imperial #3 | 0 x 1/4 | 2.9 | 20.7 | 70.2 | 9.1 | 2.0 | 13,810 | 14,220 | 15,650 | 1 | 2500 |
| Beccaria | Black Oak | ROM | 4.7 | 22.9 | 65.7 | 11.7 | 1.2 | 12,880 | 13,520 | 15,260 | 2 | ..... |
| Boardman | Potts Run #3 | ROM | 3.8 | 22.0 | 69.3 | 8.7 | 2.5 | 13,630 | 14,170 | 15,620 | 3 | 2410 |
| Houtzdale | Brookwood Shaft | ROM (Mod) | 2.4 | 20.7 | 69.8 | 9.5 | 1.2 | 13,790 | 14,130 | 15,620 | 1 | 2850 |
| Houtzdale | Brookwood Shaft | 0 x 3/4 | 3.5 | 20.4 | 69.5 | 10.1 | 1.2 | 13,580 | 14,060 | 15,640 | 1 | 2750 |
| Houtzdale | Clyde #28 | ROM (Mod) | 2.5 | 21.0 | 69.9 | 9.1 | 1.6 | 13,840 | 14,190 | 15,610 | 4 | 2710 |
| Houtzdale | Clyde #28 | ROM | 2.9 | 21.8 | 70.0 | 8.2 | 1.0 | 13,880 | 14,300 | 15,580 | 1 | 2870 |
| Houtzdale | Clyde #28 | 1 x 2 1/2 | 1.3 | 21.5 | 69.2 | 9.3 | 1.2 | 13,940 | 14,120 | 15,570 | 5 | ..... |
| Houtzdale | Clyde #28 | 1 1/4" Nut & Slack | 3.2 | 21.8 | 69.4 | 8.8 | 1.3 | 13,830 | 14,280 | 15,660 | 1 | 2810 |
| Houtzdale | Clyde #28 | 1 1/4" Nut & Slack | 3.4 | 22.0 | 69.4 | 8.6 | 1.1 | 13,800 | 14,290 | 15,630 | 1 | 2860 |
| Houtzdale | Elizabeth | ROM | 2.8 | 22.3 | 66.1 | 11.6 | 1.4 | 13,310 | 13,690 | 15,490 | 1 | ..... |
| Houtzdale | Hale #1 | ROM | 2.8 | 24.1 | 64.7 | 11.2 | 1.4 | 13,210 | 13,590 | 15,310 | 1 | ..... |
| Houtzdale | Imperial #2 | ROM | 2.0 | 22.2 | 65.3 | 12.5 | 2.2 | 13,260 | 13,530 | 15,470 | 1 | 2580 |
| Houtzdale | Imperial #2 | ROM | 2.0 | 21.9 | 68.6 | 9.5 | 1.1 | 13,910 | 14,190 | 15,680 | 1 | T.P. 590 |

Table 12. Proximate Analyses of Coal as Shipped and Delivered (Contd.)

| Locality Near | Mine | Size of Coal | Proximate Analysis | | | | | | B. T. U. Per Pound | | | Ash-fusion | | |
|------------------|------------------|--------------------|--------------------|----------|--------|-------|--------|--------|--------------------|--------|-------|------------|----------|-----------------|
| | | | Moisture | Volatile | Matter | Fixed | Carbon | Sulfur | Ash | Dry | Gross | Ash-free | Moisture | No. of Analyses |
| | | | | | | | | | | | | | | |
| Houtzdale | Imperial #2 | 2 x 5 | 1.9 | 21.8 | 69.5 | 8.7 | 1.3 | 14,050 | 14,320 | 15,680 | 5 | ..... | ..... | T.P. 590 |
| Houtzdale | Imperial #2 | 1 1/4 x 3 1/4" | 1.5 | 21.4 | 68.6 | 10.0 | 1.3 | 13,880 | 14,090 | 15,660 | 16 | ..... | ..... | T.P. 590 |
| Houtzdale | Imperial #3 | ROM | 2.2 | 21.7 | 69.6 | 8.7 | 1.0 | 14,030 | 14,350 | 15,710 | 1 | 2870 | 1 | T.P. 590 |
| Houtzdale | Imperial #3 | Lump | 1.8 | 20.5 | 70.6 | 8.9 | 1.6 | 14,020 | 14,280 | 15,670 | 1 | ..... | ..... | T.P. 590 |
| Houtzdale | Imperial #3 | 3/4" Slack | 1.9 | 21.4 | 70.2 | 8.4 | 1.3 | 14,060 | 14,340 | 15,660 | 1 | 2790 | 1 | T.P. 590 |
| Houtzdale | Imperial #3 | 3/4" Slack | 3.3 | 22.2 | 69.6 | 8.2 | 1.2 | 13,910 | 14,380 | 15,660 | 9 | 2820 | 4 | T.P. 590 |
| Houtzdale | Imperial #3 | 3/4" Slack | 3.0 | 21.4 | 70.6 | 8.0 | 1.6 | 13,980 | 14,410 | 15,660 | 4 | 2630 | 4 | T.P. 590 |
| Houtzdale | Imperial #4 | 1 1/4" Nut & Slack | 2.2 | 23.0 | 65.2 | 11.8 | 2.1 | 13,410 | 13,720 | 15,550 | 1 | 2600 | 1 | T.P. 590 |
| Houtzdale | Mascot #1 | ROM | 1.6 | 21.5 | 66.1 | 12.4 | 2.3 | 13,390 | 13,610 | 15,540 | 1 | 2510 | 1 | T.P. 590 |
| Houtzdale | Mascot #1 | ROM | 1.2 | 21.6 | 66.3 | 12.1 | 3.1 | 13,450 | 13,620 | 15,500 | 1 | 2330 | 1 | T.P. 590 |
| Madera | Mid Penn #4 | ROM | 1.5 | 20.9 | 68.1 | 11.0 | 3.5 | 13,620 | 13,830 | 15,540 | 1 | 2310 | 1 | T.P. 590 |
| Madera | Mid Penn #7 | ROM | 2.2 | 21.6 | 69.0 | 9.4 | 2.1 | 13,830 | 14,140 | 15,140 | 1 | ..... | ..... | T.P. 590 |
| Madera | Universal #1 | ROM | 1.9 | 19.9 | 67.4 | 12.7 | 3.2 | 13,240 | 13,500 | 15,460 | 4 | 2440 | 3 | T.P. 645 |
| Madera | Universal #1 | 0 x 1 1/4" | 2.2 | 18.1 | 68.6 | 13.3 | 2.4 | 13,180 | 13,470 | 15,540 | 1 | ..... | ..... | T.P. 645 |
| Madera | Universal #1 | 0 x 3/4" | 3.4 | 18.8 | 68.0 | 13.2 | 2.6 | 13,020 | 13,480 | 15,530 | 1 | 2540 | 1 | T.P. 645 |
| Yorkshire | Yorkshire | ROM | 2.0 | 19.6 | 69.9 | 10.5 | 2.6 | 13,580 | 13,860 | 15,490 | 3 | ..... | ..... | T.P. 590 |
| Yorkshire | Yorkshire | ROM | 5.6 | 19.6 | 70.7 | 9.7 | 2.7 | 13,280 | 14,070 | 15,580 | 4 | ..... | ..... | T.P. 590 |
| Yorkshire | Yorkshire | ROM | 1.5 | 19.4 | 68.4 | 12.2 | 3.0 | 13,400 | 13,600 | 15,490 | 1 | 2330 | 1 | T.P. 590 |
| Yorkshire | Yorkshire | ROM | 1.3 | 19.6 | 68.4 | 12.0 | 3.0 | 13,480 | 13,660 | 15,520 | 1 | 2360 | 1 | T.P. 590 |
| Yorkshire | Yorkshire | ROM | 1.7 | 19.6 | 68.5 | 11.9 | 2.9 | 13,420 | 13,650 | 15,490 | 18 | ..... | ..... | T.P. 590 |
| Yorkshire | Yorkshire | ROM | 1.8 | 19.8 | 70.1 | 10.1 | 2.9 | 13,740 | 13,990 | 15,560 | 1 | ..... | ..... | T.P. 590 |
| Madera | Madera | ROM | 2.6 | 19.0 | 70.0 | 11.0 | 2.6 | 13,490 | 13,850 | 15,570 | 1 | 2530 | 1 | T.P. 590 |
| Yorkshire | Yorkshire | ROM | 1.5 | 18.4 | 67.7 | 13.9 | 2.9 | 13,120 | 13,320 | 15,470 | 3 | ..... | ..... | T.P. 590 |
| Yorkshire | Yorkshire | ROM | 1.6 | 19.3 | 70.3 | 10.4 | 2.7 | 13,700 | 13,920 | 15,540 | 2 | 2310 | 1 | T.P. 590 |
| Madera | 3/4 x 1 3/4" Nut | ROM | 1.8 | 17.8 | 66.1 | 16.1 | 3.7 | 12,780 | 13,020 | 15,520 | 1 | 2480 | 1 | T.P. 590 |
| Madera | Baltic Shaft | ROM | 2.3 | 18.6 | 70.3 | 11.1 | 2.6 | 13,520 | 13,840 | 15,560 | 1 | 2490 | 1 | T.P. 590 |
| Osecola Mills | Du Shan #1 | ROM | 1.9 | 22.2 | 68.8 | 9.0 | 1.8 | 13,950 | 14,220 | 15,630 | 1 | 2540 | 1 | T.P. 590 |
| Osecola Mills | Du Shan #1 | ROM | 1.4 | 25.2 | 64.2 | 10.4 | 2.1 | 13,820 | 14,010 | 15,640 | 1 | 2560 | 1 | T.P. 590 |
| Osecola Mills | Du Shan #1 | ROM | 2.4 | 23.5 | 68.2 | 8.3 | 1.0 | 14,030 | 14,370 | 15,670 | 1 | 2910- | 1 | T.P. 645 |
| Osecola Mills | Du Shan #3 | 2" lump | 3.7 | 23.0 | 69.2 | 7.8 | 1.2 | 13,730 | 14,260 | 15,470 | 1 | 2870 | 1 | T.P. 645 |

TABLE 12

Table 12. *Proximate Analyses of Coal as Shipped and Delivered* (Contd.)

Table 13. Summary of Petrographic analyses of coals in Houtzdale quadrangle.

| <i>Coal Horizon</i> | <i>Vitrinoids</i> | <i>Exinoids</i> | <i>Micrinoids</i> | <i>Semi-fusinite</i> | <i>Fusinite</i> | <i>Ash</i> | <i>Number Sampled</i> |
|----------------------------|-------------------|-----------------|-------------------|----------------------|-----------------|------------|-----------------------|
| CONEMAUGH | | | | | | | |
| Mahoning coal | 84.1 | 2.3 | 3.7 | 2.4 | 7.5 | 14.1 | 1 |
| Upper Freeport rider coal | 79.0 | 3.4 | 6.8 | 2.4 | 8.4 | 16.3 | 1 |
| ALLEGHENY | | | | | | | |
| Upper Freeport coal (E) | 92.4 | 2.0 | 2.3 | 0.6 | 2.7 | 8.2 | 8 |
| Lower Freeport coal (D) | 88.7 | 2.3 | 4.2 | 1.0 | 3.8 | 7.5 | 11 |
| Upper Kittanning coal (C') | 83.6 | 3.5 | 3.5 | 1.3 | 8.1 | 12.1 | 6 |
| Middle Kittanning coal (C) | 89.4 | 3.6 | 3.3 | 0.9 | 2.8 | 8.6 | 8 |
| Lower Kittanning coal | | | | | | | |
| B-5 | 87.1 | 2.3 | 3.0 | 1.8 | 5.8 | 14.1 | 3 |
| B-4 | 93.2 | 3.5 | 2.2 | 0.3 | 0.8 | 6.6 | 6 |
| B-3b | 86.2 | 5.7 | 4.7 | 0.7 | 2.7 | 8.0 | 8 |
| B-3a | 92.2 | 3.1 | 2.4 | 0.6 | 1.7 | 6.5 | 17 |
| B-2 (B) | 84.7 | 4.2 | 4.9 | 1.4 | 4.8 | 12.3 | 5 |
| B-1 | 86.5 | 2.4 | 4.6 | 1.6 | 4.9 | 9.2 | 4 |
| Clarion coals (A', A) | | | | | | | |
| Clarion 2 | 83.3 | 4.8 | 5.9 | 1.0 | 5.0 | 9.0 | 4 |
| Clarion 1 | 87.4 | 2.9 | 3.9 | 1.1 | 4.7 | 7.1 | 5 |
| POTTSVILLE | | | | | | | |
| Mercer (undifferentiated) | 78.6 | 3.3 | 8.0 | 3.5 | 6.6 | 12.8 | 3 |

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APPENDIX

CONEMAUGH COALS

SAMPLE NO: 85-C-38 Mahoning

COMPANY: Thompson Mine
 LOCATION: Glen Richey $7\frac{1}{2}$ Quadrangle
 14,200' North $40^{\circ} 55'$
 10,300' East $78^{\circ} 30'$

| inches | V | E | M | SF | F | ASH | |
|---------|------|-----|-----|-----|------|------|-----------|
| 0-7 | 86.0 | 2.8 | 3.6 | 2.2 | 5.4 | 8.9 | |
| 7-19 | 83.4 | 2.0 | 4.6 | 3.4 | 6.6 | 15.3 | Canneloid |
| 19-29 | 83.6 | 2.4 | 2.8 | 1.2 | 10.0 | 16.3 | |
| | V | E | M | SF | F | ASH | |
| Average | 84.1 | 2.3 | 3.7 | 2.4 | 7.5 | 14.1 | |

SAMPLE NO: 85-C-22 Upper Freeport rider

COMPANY: Simca Mining
 LOCATION: Glen Richey $7\frac{1}{2}$ Quadrangle
 10,200' South $41^{\circ} 00'$
 7,300' West $78^{\circ} 25'$

| | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| Average | 79.0 | 3.4 | 6.8 | 2.4 | 8.4 | 16.3 |

Local block in faulty sandstone -10 feet across
 Thickness 0 - 4'+
 Cut out by slumping and sandstone. No accurate
 bed thickness available at time of sampling.
 Operator reported pods up to 6' thick

SAMPLE NO: 85-C-85 Upper Freeport rider

COMPANY: unknown
 LOCATION: Ramey $7\frac{1}{2}$ Quadrangle
 4,400' North $40^{\circ} 45'$
 8,600' West $78^{\circ} 25'$

| | V | E | M | SF | F | ASH |
|---------|---|---|---|----|---|-----|
| Average | | | | | | |

At crop $\frac{1}{2}$ ' thick, 15.0 % ash, sampled
 canneloid with irregular clay veins. Too
 weathered for microscopic examination.

UPPER FREEPORT COALS

SAMPLE NO: 85-C-8 Upper Freeport
COMPANY: Thompson Coal Co.
LOCATION: Glen Richey Quadrangle
12,000' North 40° 55'
6,900' East 78° 30'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-8 | 92.8 | 1.2 | 2.8 | — | 3.2 | 4.8 |
| 8-18 | 98.4 | 0.4 | 1.2 | — | — | 6.3 |
| 18-27 | 91.4 | 0.6 | 2.0 | 2.0 | 4.0 | 11.7 |
| 27-31 | 94.0 | 1.2 | 2.4 | — | 2.4 | 15.5 |
| | V | E | M | SF | F | ASH |
| Average | 94.3 | 0.8 | 2.0 | 0.6 | 2.3 | 8.7 |

Sample badly weathered

SAMPLE NO: 85-C-27 Upper Freeport
COMPANY: unknown Strip mine
LOCATION: Glen Richey $7\frac{1}{2}$ Quadrangle
4,000' North $40^{\circ} 55'$
11,200' East $78^{\circ} 30'$

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-5 | 88.0 | 2.0 | 3.8 | 0.6 | 5.6 | 9.6 |
| 5-10 | 88.8 | 3.8 | 2.4 | 0.6 | 4.4 | 3.1 |
| 10-22 | 94.8 | 1.2 | 2.0 | 0.0 | 2.0 | 6.3 |
| 22-28 | 92.0 | 1.0 | 3.8 | 0.2 | 3.0 | 17.5 |
| 28-30 | | | | | | |
| 30-31 | | | | | | |
| | V | E | M | SF | F | ASH |
| Average | 91.8 | 1.8 | 2.8 | 0.3 | 3.3 | 8.7 |

* excluded from totals

SAMPLE NO: 85-C-23 Upper Freeport
COMPANY: Simca Coal Co.
LOCATION: Glen Richey Quadrangle
10,500' South 41° 00'
7,300' West 78° 25'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-2 | 88.4 | 2.2 | 3.8 | 0.6 | 5.0 | 8.5 |
| 2½-13 | 91.0 | 1.4 | 1.6 | 0.0 | 3.0 | 6.9 |
| 13½-20½ | 94.0 | 1.4 | 1.6 | 0.0 | 3.0 | 6.9 |
| 20½-29 | 86.2 | 1.0 | 4.0 | 0.2 | 8.6 | 15.3 |
| | V | E | M | SF | F | ASH |
| Average | 90.1 | 1.7 | 2.7 | 0.5 | 5.0 | 8.4 |

Clay $\frac{1}{2}$ "

Clay $\frac{1}{2}$ "

SAMPLE NO: 85-C-27 Upper Freeport
COMPANY: unknown Strip mine
LOCATION: Glen Richey $7\frac{1}{2}$ Quadrangle
4,000' North $40^{\circ} 55'$
11,200' East $78^{\circ} 30'$

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-5 | 88.0 | 2.0 | 3.8 | 0.6 | 5.6 | 9.6 |
| 5-10 | 88.8 | 3.8 | 2.4 | 0.6 | 4.4 | 3.1 |
| 10-22 | 94.8 | 1.2 | 2.0 | 0.0 | 2.0 | 6.3 |
| 22-28 | 92.0 | 1.0 | 3.8 | 0.2 | 3.0 | 17.5 |
| 28-30 | | | | | | |
| 30-31 | | | | | | |
| | V | E | M | SF | F | ASH |
| Average | 91.8 | 1.8 | 2.8 | 0.3 | 3.3 | 8.7 |

* excluded from totals

SAMPLE NO: 85-C-28 Upper Freeport
COMPANY: Thompson
LOCATION: Glen Richey Quadrangle
12,000' North 40° 55'
9,700' East 78° 30'

| inches | V | E | M | SF | F | ASH |
|--------|------|-----|-----|-----|-----|------|
| 0-9 | 89.6 | 2.8 | 3.4 | 0.8 | 3.4 | 5.2 |
| 9-22 | 96.4 | 1.6 | 0.8 | — | 1.2 | 4.4 |
| 22-29 | 93.6 | 2.0 | 1.6 | 0.8 | 2.0 | 13.4 |
| 31-32 | 96.8 | 0.2 | 1.6 | — | 1.4 | 13.4 |
| | V | E | M | SF | F | ASH |

| | | | | | | |
|---------|------|-----|-----|-----|-----|-----|
| Average | 93.7 | 2.0 | 1.8 | 0.4 | 2.1 | 7.0 |
|---------|------|-----|-----|-----|-----|-----|

UPPER FREEPORT COALS

SAMPLE NO: 85-C-61 Upper Freeport

COMPANY: Elliott Coal Co.
 LOCATION: Houtzdale 7½ Quadrangle
 10,500' North 40° 50'
 9,400' West 78° 20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| | | | | | | |
| 0-6 | 89.4 | 4.2 | 3.8 | 1.2 | 1.4 | 5.6 |
| 6-10 | 88.4 | 7.0 | 2.0 | 1.6 | 1.0 | 4.8 |
| 10-17 | 94.2 | 3.0 | 1.6 | — | 1.2 | 4.8 |
| 17-23 | 96.0 | 1.6 | 1.2 | — | 1.2 | 6.6 |
| 23½-28 | 92.0 | 1.8 | 3.0 | 0.2 | 3.0 | 12.8 |
| 28-32 | 89.6 | 1.6 | 4.4 | 1.4 | 3.0 | 17.1 |
| | V | E | M | SF | F | ASH |
| Average | 92.0 | 3.1 | 2.6 | 0.6 | 1.7 | 8.0 |

SAMPLE NO: 85-C-83 Upper Freeport

COMPANY: unknown - near crop
 LOCATION: Ramey 7½ Quadrangle
 3,800' North 40° 45'
 7,000' West 78° 25'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| | | | | | | |
| 0-4 | 96.2 | 2.0 | 1.4 | — | 0.4 | 6.4 |
| 4-9 | 95.2 | 1.8 | 1.4 | — | 1.6 | 6.2 |
| 9½-16½ | 94.2 | 2.0 | 1.4 | — | 2.4 | 8.3 |
| 17-23 | 92.6 | 3.2 | 1.0 | — | 3.2 | 12.6 |
| 23½-29½ | 91.6 | 3.8 | 2.4 | 0.4 | 1.8 | 13.3 |
| | V | E | M | SF | F | ASH |
| Average | 93.8 | 2.6 | 1.5 | 0.1 | 2.0 | 9.6 |

Sample badly weathered

SAMPLE NO: 85-C-84 Upper Freeport

COMPANY: unknown
 LOCATION: Ramey 7½ Quadrangle
 4,600' North 40° 45'
 8,600' West 78° 25'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|-----|
| | | | | | | |
| 0-5 | 91.4 | 1.8 | 5.0 | 1.0 | 0.8 | 4.8 |
| 5-15 | 92.8 | 1.6 | 2.2 | 0.4 | 3.0 | 5.3 |
| 16-23½ | 89.0 | 1.2 | 3.2 | 2.6 | 4.0 | 6.4 |
| 24-26½ | 96.4 | 0.6 | 1.0 | 1.0 | 1.0 | 5.3 |
| 27½-30½ | * | — | — | — | — | — |
| | V | E | M | SF | F | ASH |
| Average | 91.7 | 1.4 | 2.9 | 1.3 | 2.7 | 5.5 |

Some layers weathered

* Not analyzed

SAMPLE NO: 85-C-89 Upper Freeport

COMPANY: Ryan Bros. Coal Co.
 LOCATION: Glen Richey Quadrangle
 1,800' South 40° 55'
 4,800' East 78° 30'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| | | | | | | |
| 0-7 | 88.2 | 5.2 | 3.6 | 0.6 | 2.4 | 7.8 |
| 7-12 | 90.6 | 3.8 | 0.8 | — | 4.8 | 3.7 |
| 12-18½ | 96.8 | 1.2 | 0.8 | — | 1.2 | 7.8 |
| 18½-23 | 93.6 | 1.6 | 2.0 | 1.0 | 1.8 | 16.7 |
| 23-28 | 90.4 | 0.4 | 3.2 | 2.0 | 4.0 | 13.9 |
| | V | E | M | SF | F | ASH |
| Average | 91.9 | 2.6 | 2.1 | 0.7 | 2.7 | 9.6 |

LOWER FREEPORT COALS

SAMPLE NO: 85-C-7 Lower Freeport

COMPANY: road cut *
LOCATION: Glen Richey 7½ Quadrangle
12,400' North 40° 55'
6,200' East 78° 30'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-2 | | | | | | |
| 2-9 | 85.4 | 0.4 | 7.8 | 1.4 | 5.0 | 8.7 |
| 9-16 | 88.0 | 1.2 | 4.2 | 1.0 | 5.6 | 9.8 |
| 16-16½ | | | | | | |
| 16½-26 | 87.4 | 1.2 | 4.4 | 0.6 | 6.4 | 9.5 |
| 26-29 | | | | | | |
| 29-35 | 86.9 | 1.2 | 4.4 | 0.6 | 6.4 | 9.5 |
| 35-38 | 95.4 | 1.2 | 3.0 | 0.2 | 0.2 | 11.8 |
| | V | E | M | SF | F | ASH |
| Average | 87.7 | 1.0 | 5.2 | 1.1 | 5.0 | 9.5 |

* Poorly exposed and preserved

SAMPLE NO: 85-C-24 Lower Freeport rider

COMPANY: Simca Mine
LOCATION: Glen Richey 7½ Quadrangle
10,100' South 41° 00'
7,000' West 78° 25'

| inches | V | E | M | SF | F | ASH |
|---------------------------------|---|---|---|----|---|-----|
| High ash coal | | | | | | |
| 0-29 | | | | | | |
| Clay parting | | | | | | |
| Weathered outcrop no microscopy | | | | | | 8.8 |
| Average | V | E | M | SF | F | ASH |

SAMPLE NO: 85-C-25 Lower Freeport

COMPANY: Simca Mine
LOCATION: Glen Richey 7½ Quadrangle
10,400' South 41° 00'
6,900' West 78° 25'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-2 | 86.0 | 4.8 | 5.8 | 1.4 | 2.0 | 20.2 |
| 2-5 | 89.6 | 2.6 | 3.8 | 1.8 | 2.2 | 10.6 |
| 5-10 | 88.4 | 1.6 | 4.2 | 1.0 | 4.8 | 8.2 |
| 10-21 | 90.2 | 2.0 | 2.6 | — | 5.2 | 7.6 |
| 21-25 | 94.4 | 0.2 | 3.6 | 0.6 | 1.2 | 9.3 |
| 25-26½ | 92.0 | 1.2 | 4.2 | 0.8 | 1.8 | 10.2 |
| | V | E | M | SF | F | ASH |
| Average | 90.5 | 1.8 | 3.6 | 0.7 | 3.4 | 9.5 |

SAMPLE NO: 85-C-29 Lower Freeport

COMPANY: J.A. Thompson
LOCATION: Glen Richey 7½ Quadrangle
13,100' North 40° 55'
9,900' East 78° 30'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-3 | | N. | A. | | | 26.7 |
| 3-4½ | | | | | | |
| 4½-17 | 88.0 | 2.0 | 6.6 | 1.0 | 2.4 | 9.1 |
| 17-17½ | | | | | | |
| 17½-30 | 90.4 | 2.0 | 3.2 | 0.2 | 4.2 | 5.4 |
| 30-32½ | | | | | | |
| 32½-37 | 87.8 | 1.8 | 5.0 | 1.0 | 4.4 | 12.1 |
| | V | E | M | SF | F | ASH |
| Average | 89.0 | 2.0 | 4.9 | 0.6 | 3.5 | 8.0 |

LOWER FREEPORT COALS

SAMPLE NO: 85-C-39 Lower Freeport

COMPANY: Thompson Strip mine
 LOCATION: Glen Richey $7\frac{1}{2}$ Quadrangle
 12,300' North $40^{\circ} 50'$
 11,200' East $78^{\circ} 30'$

| inches | V | E | M | SF | F | ASH | |
|----------------------|------|------|-----|-----|-----|------|-----------|
| 0-5 | 82.6 | 10.4 | 7.0 | — | — | 18.7 | Canneloid |
| 5-11 | 83.8 | 3.4 | 6.0 | 2.2 | 4.6 | 5.1 | |
| 11-17 | 91.0 | 3.2 | 3.0 | 0.8 | 2.0 | 6.0 | |
| 17 $\frac{1}{2}$ -29 | 90.6 | 2.4 | 3.6 | 2.2 | 1.2 | 5.7 | |
| 29-32 $\frac{1}{2}$ | | | | | | | |
| 32 $\frac{1}{2}$ -34 | 85.6 | 2.4 | 5.4 | 1.6 | 5.0 | 24.7 | |
| | V | E | M | SF | F | ASH | |
| Average | 87.8 | 4.1 | 4.6 | 1.5 | 2.0 | 8.8 | |

SAMPLE NO: 85-C-53 Lower Freeport

COMPANY: mine - unknown
 LOCATION: Ramey Quadrangle
 7,500' North $40^{\circ} 50'$
 6,800' East $78^{\circ} 25'$

| inches | V | E | M | SF | F | ASH | |
|------------------------------------|------|-----|-----|-----|-----|-----|-----------------|
| 0-6 | 75.8 | 2.6 | 8.8 | 4.6 | 8.2 | 5.5 | |
| 6-11 | 83.4 | 2.6 | 4.8 | 5.4 | 3.8 | 3.5 | |
| 11-16 $\frac{1}{2}$ | 81.6 | 2.6 | 4.2 | 3.4 | 8.2 | 3.1 | Fusain parting |
| 16 $\frac{1}{2}$ -22 | 89.4 | 1.6 | 5.2 | 0.8 | 3.0 | 3.6 | |
| 22-26 $\frac{1}{2}$ | 91.2 | 1.6 | 3.2 | 0.8 | 3.2 | 5.7 | |
| 27 $\frac{1}{2}$ -33 $\frac{1}{2}$ | 93.2 | 3.2 | 1.2 | 1.0 | 1.4 | 4.2 | Canneloid |
| 33 $\frac{1}{2}$ -41 $\frac{1}{2}$ | 93.0 | 3.6 | 2.0 | 1.4 | — | 4.0 | Fusain and clay |
| 41 $\frac{1}{2}$ -47 | 92.6 | 2.2 | 2.0 | 1.0 | 2.2 | 3.9 | Shaly parting |
| | V | E | M | SF | F | ASH | |
| Average | 88.6 | 2.8 | 3.5 | 1.9 | 3.2 | 4.2 | |

LOWER FREEPORT COALS

SAMPLE NO: 85-C-62 Lower Freeport

COMPANY: Strip mine near Gallagher *

LOCATION: Houtzdale 7½ Quadrangle

6,500' North 40° 50'

3,200' West 78° 20'

| inches | V | E | M | SF | F | ASH |
|---------|------------|-----|------|-----|------|------|
| 0-5½ | 84.4 | 2.4 | 2.8 | — | 10.4 | 11.0 |
| 5½-7½ | 94.6 | 1.8 | 2.2 | — | 1.4 | 17.3 |
| | Clay | | | | | |
| 7½-19 | 77.6 | 2.0 | 11.2 | — | 9.2 | 8.5 |
| | | | | | | |
| 19-31 | 75.4 | 1.2 | 9.2 | 2.6 | 11.6 | 5.3 |
| | | | | | | |
| 31-42 | 92.8 | — | 4.0 | 1.0 | 2.2 | 5.3 |
| | Brown clay | | | | | |
| 42-47½ | 95.8 | 1.2 | 0.6 | 0.4 | 2.0 | 5.5 |
| | | | | | | |
| 47½-61½ | 91.2 | 2.0 | 2.8 | 2.0 | 2.0 | 4.1 |
| | | | | | | |
| 61½-69 | 96.0 | 1.8 | 1.2 | — | 1.0 | 6.3 |
| | | | | | | |
| | V | E | M | SF | F | ASH |
| Average | 87.0 | 1.8 | 1.2 | — | 1.0 | 6.3 |

* Badly weathered at top of bed

SAMPLE NO: 85-C-86 Lower Freeport

COMPANY: 3 B's

LOCATION: Ramey 7½ Quadrangle

1,600' North 40° 45'

9,300' West 78° 25'

| inches | V | E | M | SF | F | ASH |
|---------|-------------------|-----|-----|-----|-----|-----|
| 0-5 | 92.0 | 2.2 | 2.4 | 0.8 | 2.6 | 6.7 |
| 5-11 | 90.0 | 3.4 | 2.8 | 0.4 | 3.4 | 5.0 |
| 11-14½ | 88.0 | 2.6 | 3.6 | 3.8 | 2.0 | 6.2 |
| | Carbonaceous clay | | | | | |
| 14½-21½ | 94.2 | 0.6 | 1.8 | 0.4 | 3.0 | 8.3 |
| 21½-26 | 92.0 | 0.8 | 2.4 | 0.2 | 4.6 | 7.6 |
| | | | | | | |
| | V | E | M | SF | F | ASH |
| Average | 91.5 | 1.9 | 2.5 | 0.9 | 3.2 | 6.8 |

LOWER FREEPORT COALS

SAMPLE NO: 85-C-58 Lower Freeport

COMPANY: unknown - underground mine

LOCATION: Ramsey 7½ Quadrangle
2,100' North 40° 50'
1,000' West 78° 25'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-2½ | 89.0 | 2.2 | 7.0 | | 1.8 | 13.8 |
| 2½-9 | 94.6 | 0.8 | 2.4 | 1.0 | 1.2 | 6.1 |
| 9-16 | 92.2 | 0.8 | 2.4 | 0.2 | 4.4 | 6.1 |
| 16-21 | 93.8 | 1.0 | 1.8 | 0.2 | 3.2 | 3.8 |
| 21-27½ | 94.6 | 1.0 | 2.6 | | 1.8 | 4.4 |
| 27½-37½ | 88.4 | 3.0 | 2.8 | 0.6 | 5.2 | 6.2 |
| | V | E | M | SF | F | ASH |
| Average | 91.9 | 1.6 | 2.8 | 0.4 | 3.3 | 6.1 |

Fusain and clay

Discontinuous Parting

SAMPLE NO: 85-C-71 Lower Freeport

COMPANY: Elliot

LOCATION: Houtzdale 7½ Quadrangle
11,000' North 40° 50'
9,800' West 78° 20'

| inches | V | E | M | SF | F | ASH |
|---------|-------|------|-------|-----|-----|------|
| 0-2 | Roof | Coal | Shaly | | | |
| 2-4 | 92.0 | 4.6 | 3.0 | | 0.4 | 4.6 |
| 4-12 | 92.0 | 4.4 | 1.6 | 1.2 | 0.8 | 4.2 |
| 12-18 | 88.4 | 4.0 | 2.0 | 1.2 | 4.4 | 19.4 |
| 18-22 | Dirty | Coal | | | | |
| 22-28 | 87.2 | 3.8 | 4.6 | 1.6 | 2.8 | 10.6 |
| | V | E | M | SF | F | ASH |
| Average | 87.2 | 4.1 | 2.7 | 1.2 | 2.3 | 10.1 |

LOWER FREEPORT COALS

SAMPLE NO: 85-C-76 Lower Freeport

COMPANY: Strip mine - unknown

LOCATION: Nottzdale 7½ Quadrangle
2,800' South 40° 30'
8,700' West 78° 15'

| inches | V | E | M | SF | F | ASH | |
|---------|-------|-------|------|-----|-----|------|-------------------|
| 0-9 | 86.6 | 2.4 | 6.4 | 1.6 | 3.0 | 11.9 | |
| 9-13 | 79.5 | 6.5 | 11.0 | 1.0 | 2.0 | 24.6 | Cannel |
| 13-20 | 73.8 | 3.4 | 11.8 | 4.8 | 6.2 | 8.1 | |
| 20-24½ | 79.4 | 1.8 | 9.4 | 3.6 | 5.8 | 7.1 | |
| 24½-39 | 89.2 | 1.2 | 3.0 | 1.2 | 5.4 | 6.1 | |
| 39-42 | 92.0 | 0.8 | 2.2 | 1.4 | 3.6 | 6.1 | Carbonaceous clay |
| 42-56 | 92.8 | 2.2 | 1.4 | 0.8 | 2.8 | 6.0 | |
| 56-65 | 93.8 | 2.2 | 1.2 | 0.8 | 2.0 | 5.2 | |
| 65-75 | 94.6 | 1.4 | 1.0 | 0.6 | 2.4 | 7.9 | |
| 75-81 | Coaly | Shale | | | | | |
| Average | 88.3 | 2.2 | 4.3 | 1.5 | 3.7 | 8.2 | |

LOWER FREEPORT COALS

SAMPLE NO: 85-C-88 Lower Freeport

COMPANY: Strip mine - unknown
 LOCATION: Ramey 7½ Quadrangle
 11,700' North 40° 45'
 11,100' East 78° 25'

| inches | V | E | M | SF | F | ASH | |
|---------|------|-----|------|-----|-----|------|--------------------|
| 0-1½ | 90.8 | 3.0 | 6.0 | — | 0.2 | 11.5 | Pyrite parting |
| 1½-7 | 94.2 | 3.0 | 2.6 | — | — | 8.6 | Carbonaceous clay |
| 7-11 | 75.6 | 3.0 | 12.0 | 1.8 | 7.6 | 8.0 | Carbonaceous shale |
| 11-17½ | 89.2 | 2.4 | 5.8 | — | 2.6 | 6.2 | |
| 17½-22 | 92.0 | 2.0 | 3.8 | — | 2.2 | 5.9 | Carbonaceous shale |
| 22-30½ | 90.8 | 4.2 | 3.6 | — | 1.4 | 9.4 | |
| | V | E | M | SF | F | ASH | |
| Average | 89.4 | 3.1 | 5.1 | 0.2 | 2.2 | 8.0 | |

SAMPLE NO: 85-C-90 Lower Freeport

COMPANY: Ryan Bros.
 LOCATION: Richey 7½ Quadrangle
 1,500' South 40° 55'
 4,900' East 78° 30'

| inches | V | E | M | SF | F | ASH | |
|---------|------|-----|-----|-----|------|-----|--|
| 0-6 | 88.6 | 3.8 | 5.6 | 0.6 | 1.4 | 6.3 | |
| 6-10½ | 77.4 | 2.2 | 1.2 | 1.6 | 17.6 | 7.1 | |
| 10½-18 | 83.8 | 4.2 | 5.8 | 1.8 | 4.4 | 7.2 | |
| 18-22 | 86.0 | 2.6 | 3.2 | 1.0 | 7.2 | 6.8 | |
| | V | E | M | SF | F | ASH | |
| Average | 84.2 | 3.4 | 4.3 | 1.3 | 6.8 | 6.9 | |

UPPER KITTANNING COALS

SAMPLE NO: 85-C-9 Upper Kittanning

COMPANY: Maple Hill Coal Co.

LOCATION: Richey $7\frac{1}{2}'$ quadrangle
3,300'S 41°00'
8,500'E 78°25'

| inches | V | E | M | SF | F | ASH |
|---------|-------------------|-----|-----|-----|------|------|
| 0 - 5 | 84.4 | 2.8 | 5.0 | 0.4 | 7.4 | 16.2 |
| 5 - 7 | 71.4 | 3.2 | 8.8 | 2.8 | 13.8 | 16.0 |
| 7 - 17 | 92.0 | 0.2 | 3.0 | 2.2 | 2.6 | 20.1 |
| | black shale | | | | | |
| 17 - 27 | 88.2 | - | 4.0 | 1.6 | 6.2 | 22.7 |
| 27 - 29 | | | | | | 42.5 |
| | black coaly shale | | | | | |
| Average | 87.5 | 0.9 | 4.2 | 1.7 | 5.7 | 19.9 |

SAMPLE NO: 85-C-20 Upper Kittanning

COMPANY: Maple Hill Coal Co.

LOCATION: Glen Richey $7\frac{1}{2}'$ quadrangle
3,200'S 41°00'
7,900'E 78°25'

| inches | V | E | M | SF | F | ASH |
|---------|-------|-----|-----|-----|-----|------|
| 0 - 2 | | | | | | 43.0 |
| 2 - 7 | 77.8 | 5.4 | 5.2 | 3.4 | 8.2 | 14.6 |
| 7 - 17 | 90.4 | 1.8 | 2.4 | - | 5.4 | 15.3 |
| 17 - 26 | 84.8 | 1.8 | 3.6 | 3.2 | 6.6 | 18.0 |
| | boney | | | | | |
| Average | 85.8 | 2.6 | 3.4 | 1.9 | 6.3 | 16.2 |

SAMPLE NO: 85-C-42 Upper Kittanning

COMPANY: unknown

LOCATION: Wallaceton $7\frac{1}{2}'$ quadrangle
12,800'S 41°00'
3,900'W 78°20'

| inches | V | E | M | SF | F | ASH |
|---------|-----------------|-----|-----|-----|------|------|
| 0 - 6 | 77.8 | 3.0 | 4.0 | 2.0 | 13.2 | 17.4 |
| | fusain and clay | | | | | |
| 6 - 12 | 92.4 | 3.2 | 1.8 | 0.4 | 2.2 | 8.0 |
| | | | | | | |
| Average | 84.8 | 3.1 | 3.0 | 1.2 | 7.9 | 12.9 |

UPPER KITTANNING COALS

SAMPLE NO: 85-C-70 Upper Kittanning

COMPANY: Hansel

LOCATION: Houtzdale 7 $\frac{1}{2}$ ' quadrangle
12,300'N 40°50'
9,700'W 78°20'

| inches | V | E | M | SF | F | ASH | |
|----------------------|------|-----|-----|-----|------|-----|----------------------|
| | | | | | | | mixed shale and coal |
| 0 - 8 $\frac{1}{2}$ | 71.4 | 4.2 | 4.8 | 1.4 | 18.2 | 7.4 | |
| 8 $\frac{1}{2}$ - 13 | 80.8 | 7.0 | 2.8 | 0.4 | 9.0 | 7.9 | fusain and clay |
| Average | 75.0 | 5.3 | 4.0 | 1.0 | 14.7 | 7.6 | |

SAMPLE NO: 85-C-77 Upper Kittanning

COMPANY: Elliot

LOCATION: Houtzdale 7 $\frac{1}{2}$ ' quadrangle
4,800'S 40°50'
11,400'W 78°15'

| inches | V | E | M | SF | F | ASH | |
|-------------------------------------|------|-----|-----|-----|-----|------|--------------------|
| 0 - 5 $\frac{1}{2}$ | 86.2 | 7.4 | 4.6 | 1.2 | 0.6 | 9.9 | |
| | | | | | | | discontinuous clay |
| 5 $\frac{1}{2}$ - 14 | 95.6 | 2.6 | 1.4 | - | 0.4 | 6.8 | |
| 14 - 17 $\frac{1}{2}$ | 90.0 | 4.0 | 1.0 | 0.6 | 4.4 | 14.3 | |
| 17 $\frac{1}{2}$ - 18 $\frac{1}{2}$ | 93.4 | 2.6 | 1.8 | - | 2.2 | 14.2 | |
| Average | 91.5 | 4.3 | 2.4 | 0.5 | 1.3 | 9.5 | |

SAMPLE NO: 85-C-78 Upper Kittanning

COMPANY: Elliot

LOCATION: Houtzdale 7 $\frac{1}{2}$ ' quadrangle
4,700'S 40°50'
11,400'E 78°20'

| inches | V | E | M | SF | F | ASH | |
|---------|------|-----|-----|-----|------|-----|--|
| 0 - 4 | 58.2 | 5.0 | 6.6 | 3.4 | 26.8 | 8.5 | |
| 4 - 11 | 73.4 | 5.8 | 5.4 | 2.0 | 13.4 | 5.9 | |
| 11 - 16 | 95.8 | 3.8 | 0.4 | - | - | 5.2 | |
| Average | 76.6 | 5.0 | 4.1 | 1.7 | 12.6 | 6.3 | |

MIDDLE KITTANNING COALS

SAMPLE NO: 85-C-37 Middle Kittanning

COMPANY: Wilks Strip

LOCATION: Wallacetown $7\frac{1}{2}'$ quadrangle
1,400'S 40°55'
1,300'W 78°20'

| Inches | V | E | M | SF | F | ASH | |
|-----------------------|------|-----|-----|-----|-----|------|-------------------------------|
| 0 ~ 8 | | | | | | | alternating coal and shale |
| 8 - 12 $\frac{1}{2}$ | 86.2 | 2.4 | 2.0 | 0.8 | 8.6 | 23.0 | fusain and clay |
| 12 $\frac{1}{2}$ - 19 | 93.6 | 1.4 | 3.4 | 0.4 | .2 | 6.0 | clay |
| 19 - 27 | 87.8 | 3.4 | 2.4 | - | 6.4 | 6.4 | |
| 27 - 32 | 96.2 | 2.4 | 1.2 | - | 0.2 | 16.0 | |
| 32 - 50 | 97.8 | 1.2 | 0.8 | - | 0.2 | 5.6 | |
| 50 - 58 | 96.6 | 0.8 | 1.6 | - | 1.0 | 2.5 | |
| | V | E | M | SF | F | ASH | |
| Average | 94.5 | 1.7 | 1.6 | 0.1 | 2.1 | 7.9 | |

SAMPLE NO: 85-C-43 Middle Kittanning

COMPANY: Maple Hill Coal Co.

LOCATION: Wallacetown $7\frac{1}{2}'$ quadrangle
14,500'S 41°00'
3,700'W 78°20'

| Inches | V | E | M | SF | F | ASH | |
|-----------------------|------|-----|-----|-----|-----|------|----------------|
| 0 - 7 | 75.8 | 8.6 | 8.0 | 2.2 | 5.4 | 5.9 | canneloid |
| 7 - 13 | 82.0 | 4.2 | 7.2 | 0.8 | 5.8 | 21.7 | |
| 13 - 18 | 90.2 | 2.8 | 3.2 | .4 | 2.4 | 6.9 | pyritic fusain |
| 18 - 23 | 93.8 | 1.6 | 2.2 | 2.0 | 0.4 | 4.9 | |
| 23 - 26 $\frac{1}{2}$ | 87.6 | 0.4 | 4.8 | 3.6 | 3.6 | 9.7 | clay |
| | V | E | M | SF | F | ASH | |
| Average | 84.6 | 4.3 | 5.5 | 1.8 | 3.8 | 10.1 | |

MIDDLE KITTANNING COALS

SAMPLE NO: 85-C-52 Middle Kittanning

COMPANY: Putnam-Greene

LOCATION: Ramey $7\frac{1}{2}$ quadrangle
3,800'N 40°50'
800'E 78°25'

| inches | V | E | M | SF | F | ASH |
|---|------|-----|-----|-----|-----|-----|
| 0 - 4 | 92.6 | 1.8 | 2.6 | 0.4 | 2.6 | 7.7 |
| 4 - $7\frac{1}{2}$ | 86.4 | 4.0 | 3.2 | 1.8 | 4.6 | 3.3 |
| $7\frac{1}{2}$ - 12 | 88.6 | 4.2 | 3.2 | .4 | 2.6 | 3.4 |
| 12 - 16 | 84.2 | 4.0 | 4.0 | 1.8 | 6.0 | 8.6 |
| 16 - 24 | 95.2 | 1.4 | 1.2 | | 2.2 | 7.6 |
| coaly shale sulfuritic clay parting carbonaceous claystone coaly shale | | | | | | |
| Average | 90.1 | 2.8 | 2.7 | 0.9 | 3.5 | 6.5 |
| | V | E | M | SF | F | ASH |

SAMPLE NO: 85-C-54 Middle Kittanning

COMPANY: Henderson

LOCATION: Ramey $7\frac{1}{2}$ quadrangle
8,600'N 40°50'
8,400'E 78°25'

| inches | V | E | M | SF | F | ASH |
|----------------------|------|-----|-----|-----|-----|-----|
| 0 - 2 | 80.2 | 2.6 | 6.2 | 1.8 | 9.2 | 9.2 |
| 2 - 6 | 76.2 | 5.6 | 5.8 | 3.8 | 8.6 | 4.2 |
| 6 - 10 | 90.6 | 4.6 | 2.8 | 0.6 | 1.4 | 4.4 |
| 10 - 13 | 78.8 | 3.6 | 4.8 | 3.2 | 9.6 | 4.9 |
| 13 - 20 | 96.4 | 1.0 | 0.6 | 0.2 | 1.8 | 8.5 |
| 20 - 24 | 92.0 | 1.0 | 5.0 | - | 2.0 | 7.4 |
| 24 - $27\frac{1}{2}$ | 91.2 | 1.6 | 2.8 | 0.4 | 4.0 | 7.8 |
| | V | E | M | SF | F | ASH |
| Average | 87.8 | 2.8 | 3.6 | 1.3 | 4.5 | 6.6 |

MIDDLE KITTANNING COALS

SAMPLE NO: 85-C-63 Middle Kittanning

COMPANY: Bonita #1 - Gallagher

LOCATION: Houtzdale $7\frac{1}{2}$ ' quadrangle
6,000'N 40 $50'$
3,400'W 78 $20'$

| inches | V | E | M | SF | F | ASH |
|---------|-------------|-----|-----|-----|-----|-------------------------|
| 0 - 7 | 89.2 | 6.0 | 2.2 | 0.2 | 2.4 | 6.1 |
| 7 - 15 | 94.2 | 4.0 | 1.2 | 0.6 | - | 6.7 |
| 15 - 24 | 96.6 | .4 | 0.8 | - | 1.2 | 24.3* |
| | coaly shale | | | | | |
| 24 - 39 | 86.6 | 2.8 | 2.8 | 1.8 | 6.0 | 11.6 |
| | V | E | M | SF | F | ASH |
| Average | 90.4 | 3.5 | 2.0 | 0.9 | 3.2 | 11.6 (36")* (30") |

SAMPLE NO: 85-C-64 Middle Kittanning

COMPANY: Elliot Coal Co.

LOCATION: Houtzdale $7\frac{1}{2}$ ' quadrangle
8,800'N 40 $50'$
4,600'E 78 $20'$

| inches | V | E | M | SF | F | ASH |
|----------------------|-------------------------------|-----|-----|-----|-----|------|
| 0 - 3 $\frac{1}{2}$ | 85.6 | 9.2 | 2.4 | 0.8 | 2.0 | 4.5 |
| | fusain and clay | | | | | |
| 3 $\frac{1}{2}$ - 12 | 95.8 | 2.0 | 0.4 | 0.6 | 1.2 | 7.2 |
| 12 - 16 | 93.0 | 3.6 | 0.8 | - | 2.6 | 12.4 |
| | very dirty and clayey coal | | | | | |
| 16 - 30 | 85.2 | 3.4 | 4.2 | 2.8 | 4.4 | 10.5 |
| | V | E | M | SF | F | ASH |
| Average | 90.4 | 3.8 | 2.0 | 1.2 | 2.6 | 8.7 |

MIDDLE KITTANNING COALS

SAMPLE NO: 85-C-65 Middle Kittanning

COMPANY: Elliot Coal Co.

LOCATION: Houtzdale $7\frac{1}{2}'$ quadrangle
8,100'N 40°50'
4,300'E 78°20'

| inches | V | E | M | SF | F | ASH |
|---------|------|------|-----|-----|-----|------|
| | V | E | M | SF | F | ASH |
| 0 - 6 | 85.6 | 3.8 | 6.2 | 0.6 | 3.8 | 7.4 |
| 6 - 11 | 88.6 | 2.4 | 6.4 | 0.4 | 2.2 | 8.1 |
| 11 - 15 | 82.6 | 10.2 | 5.0 | 0.6 | 1.6 | 23.5 |
| 15 - 22 | 92.2 | 2.6 | 3.6 | 1.2 | 0.4 | 8.4 |
| Average | 87.8 | 4.3 | 5.2 | 0.7 | 2.0 | 10.8 |

high ash with clay stringers

SAMPLE NO: 85-C-66

C Rider

COMPANY: Elliot Coal Co.

LOCATION: Houtzdale $7\frac{1}{2}'$ quadrangle
8,900'N 40°50'
4,300'E 78°20'

| inches | V | E | M | SF | F | ASH |
|----------------------|------|-----|-----|-----|-----|------|
| | V | E | M | SF | F | ASH |
| 0 - 4 $\frac{1}{2}$ | 81.8 | 8.6 | 8.0 | - | 1.6 | 11.9 |
| 4 $\frac{1}{2}$ - 9 | 89.0 | 3.6 | 5.4 | 0.6 | 1.4 | 6.8 |
| 9 - 18 $\frac{1}{4}$ | 94.2 | 4.8 | 0.6 | - | 0.4 | 3.3 |
| Average | 89.8 | 5.4 | 3.7 | 0.2 | 0.9 | 6.3 |

fusain and clay

LOWER KITTANNING COALS

SAMPLE NO: 85-C-2 Lower Kittanning
 COMPANY: unknown - near crop 3a
 LOCATION: Wallacetown $7\frac{1}{2}$ quadrangle
 10,800'N $40^{\circ}55'$
 8,100'W $78^{\circ}15'$

| | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|-----|
| 0-12" | | | | | | |
| | V | E | M | SF | F | ASH |
| Average | 92.0 | 3.0 | 2.6 | 0.6 | 1.8 | 3.5 |

SAMPLE NO: 85-C-3 Lower Kittanning
 COMPANY: Maney Coal Company 3A,2
 LOCATION: Wallacetown $7\frac{1}{2}$ quadrangle
 7,500' North $40^{\circ}55'$
 2,700' West $78^{\circ}15'$

| inches | V | E | M | SF | F | ASH | |
|-----------------------|-------------------|-----|-----|-----|-----|-----|---------|
| 0 - 9 | 92.0 | 4.4 | 2.0 | | 1.6 | 4.4 | 3A |
| 9 - 18 $\frac{1}{2}$ | | | | | | | |
| | Carbonaceous Clay | | | | | | |
| 18 $\frac{1}{2}$ - 24 | | | | | | | |
| 24 - 25 | | | | | | | |
| 25 - 35 | 86.5 | 4.3 | 4.7 | 0.9 | 3.6 | 9.1 | 2 |
| 35 - 45 | | | | | | | |
| 45 - 47 $\frac{1}{2}$ | | | | | | | |
| 47 $\frac{1}{2}$ - 49 | | | | | | | Parting |
| | V | E | M | SF | F | ASH | |
| Average | 87.8 | 4.3 | 4.1 | 0.7 | 3.1 | 8.0 | |

SAMPLE NO: 85-C-4 Lower Kittanning 3B
 COMPANY: Maney Coal Company
 LOCATION: Wallacetown $7\frac{1}{2}$ quadrangle
 7,800' North $40^{\circ}55'$
 2,700' West $78^{\circ}15'$

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0 - 9 | | | | | | |
| | V | E | M | SF | F | ASH |
| Average | 88.0 | 5.8 | 5.0 | 0.2 | 1.0 | 16.5 |

LOWER KITTANNING COALS

SAMPLE NO: 85-C-14 Lower Kittanning

COMPANY: Unknown Henderson N.

4

LOCATION: Ramey $7\frac{1}{2}'$ quadrangle
10,600' North $40^{\circ}50'$
7,700' East $78^{\circ}25'$

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0 - 2 | 88.6 | 3.8 | 5.6 | — | 2.0 | 23.6 |
| 2 - 9 | 90.2 | 2.8 | 4.4 | 1.4 | 1.2 | 8.2 |
| 9 - 11 | 93.4 | 6.3 | 0.3 | — | — | 10.3 |
| | V | E | M | SF | F | ASH |
| Average | 90.5 | 3.6 | 3.9 | 0.9 | 1.1 | 11.4 |

SAMPLE NO: 85-C-11 Lower Kittanning

COMPANY: Company unknown

4

LOCATION: Ramey $7\frac{1}{2}'$ quadrangle
7,200'S $41^{\circ}00'$
7,500'E $78^{\circ}20'$

| inches | V | E | M | SF | F | ASH |
|--------------------|------|-----|-----|-----|-----|------|
| 0 - $3\frac{1}{2}$ | 89.0 | 3.6 | 6.0 | | 1.4 | 11.2 |
| $3\frac{1}{2}$ - 6 | 94.6 | 2.6 | 2.4 | | 0.4 | 10.6 |
| 6 - 10 | 92.4 | 2.2 | 3.4 | 1.2 | 0.8 | 6.1 |
| 10 - 12-3/4 | 96.4 | 2.2 | 1.2 | | 0.2 | 6.2 |
| | 94.8 | 3.0 | 2.0 | | 0.2 | 21.9 |
| | V | E | M | SF | F | ASH |
| Average | 92.7 | 2.7 | 3.5 | 0.4 | 0.7 | 9.2 |

pyritic fusain

SAMPLE NO: 85-C-13 Lower Kittanning

COMPANY: unknown - Henderson

3B

LOCATION: Ramey $7\frac{1}{2}'$ quadrangle
10,300'N $40^{\circ}50'$
8,000'E $78^{\circ}25'$

| inches | V | E | M | SF | F | ASH |
|---------------------|------|-----|-----|-----|-----|------|
| 0 - 2 | 85.4 | 6.2 | 6.8 | 0.4 | 1.2 | 13.1 |
| 2 - 6 $\frac{3}{4}$ | 87.8 | 5.8 | 5.4 | 0.4 | 0.6 | 4.7 |
| | | | | | | |
| 7 - 13 | 86.8 | 4.0 | 7.0 | 1.0 | 0.8 | 3.9 |
| 13 - 14 | | | | | | 47.4 |
| 14 - 17 | 94.4 | 1.6 | 1.8 | — | 2.2 | 7.5 |
| | V | E | M | SF | F | ASH |
| Average | 88.8 | 4.2 | 5.5 | 0.5 | 1.0 | 6.0 |

Boney coal

discontinuous clay

discontinuous clay

LOWER KITTANNING COALS

SAMPLE NO: 85-C-15 Lower Kittanning

COMPANY: Unknown

LOCATION: Ramey 7½' quadrangle
10,800' North 40°50'
7,500' East 78°25'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|------|------|
| 0 - 4 | 91.0 | 5.0 | 3.4 | — | 0.6 | 19.2 |
| 4 - 9 | 85.6 | 2.0 | 2.0 | 2.0 | 8.4 | 9.8 |
| 9 - 13 | 75.6 | 1.0 | 4.6 | 2.4 | 16.4 | 15.4 |
| 13 - 14 | | | | | | |
| 14 - 22 | 83.6 | 3.8 | 3.0 | 2.8 | 6.8 | 9.1 |
| | V | E | M | SF | F | ASH |
| Average | 84.2 | 3.1 | 3.1 | 2.0 | 7.6 | 12.3 |

Prominent fusain band
fusain and clay

pyritic fusain

dark gray shale

SAMPLE NO: 85-C-17 Lower Kittanning

COMPANY: Unknown

2,3A

LOCATION: Wallacetown 7½' quadrangle
8,700' North 40°55'
8,300' East 78°20'

| inches | V | E | M | SF | F | ASH |
|----------|------|-----|-----|-----|-----|------|
| +2 - 0 | | | | | | |
| 0 - 3½ | 91.8 | 4.2 | 3.6 | — | 0.4 | 8.8 |
| 3½ - 6 | 94.2 | 4.0 | 0.8 | — | 1.0 | 11.6 |
| 6 - 15 | | | | | | |
| 15 - 20 | 84.0 | 4.6 | 5.8 | 1.4 | 4.2 | 12.0 |
| 20 - 26 | 79.6 | 6.6 | 5.4 | 1.4 | 7.0 | 9.5 |
| 26 - 27½ | | | | | | 26.4 |
| 27½ - 33 | 86.0 | 3.0 | 4.6 | 0.6 | 5.8 | 10.6 |
| 33 - 35 | | | | | | |
| 35 - 42 | 87.4 | 3.4 | 3.8 | 2.0 | 3.4 | 15.4 |
| | V | E | M | SF | F | ASH |
| Average | 92.6 | 4.2 | 2.5 | — | 0.7 | 10.0 |
| Average | 83.9 | 4.5 | 4.9 | 1.4 | 5.3 | 12.0 |
| Average | 85.6 | 4.5 | 4.5 | 1.1 | 4.3 | 11.6 |

coaly shale

3a

Pyritic

coaly clay - shale

Pyritic

2

*

All

* Note- Excluded from totals

LOWER KITTANNING COALS

SAMPLE NO: 85-C-18 Lower Kittanning
COMPANY: 3A

LOCATION: Wallacetown 7½' Quadrangle
 8,700' North 40°55'
 8,300' East 78°20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|-----|
| 0 - 14 | | | | | | |
| | V | E | M | SF | F | ASH |
| Average | 83.0 | 5.4 | 7.0 | 0.6 | 4.0 | 6.6 |

SAMPLE NO: 85-C-32 Lower Kittanning
COMPANY: 1

LOCATION: Glen Richey 7½' quadrangle
 11,100' South 40°55'
 9,700' East 78°30'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0 - 4½ | 79.8 | 3.8 | 5.6 | 1.8 | 9.0 | 10.9 |
| 4½ - 7 | 88.6 | 2.8 | 3.6 | 0.8 | 4.2 | 12.6 |
| 7 - 8 | | | | | | |
| 8 - 14 | 90.2 | 1.0 | 5.0 | 1.0 | 2.8 | 7.4 |
| 14 - 21 | 89.4 | 1.2 | 4.8 | 0.4 | 4.2 | 7.1 |
| | V | E | M | SF | F | ASH |
| Average | 87.4 | 1.9 | 4.9 | 0.9 | 4.9 | 8.6 |

fusain
carbonaceous shale
discontinuous fusain

SAMPLE NO: 85-C-33 Lower Kittanning

COMPANY: 3A

LOCATION: Glen Richey 7½' quadrangle
 11,200' South 40°55'
 10,000' East 78°30'

| inches | V | E | M | SF | F | ASH |
|----------|------|-----|-----|-----|-----|------|
| 0 - 3 | 89.2 | 4.2 | 4.0 | — | 2.6 | 6.7 |
| 3 - 8 | 95.2 | 2.0 | 2.0 | — | 0.8 | 6.1 |
| 8 - 8½ | | | | | | |
| 8½ - 14½ | 93.4 | 1.6 | 2.0 | — | 3.0 | 11.1 |
| 14½ - 16 | 91.2 | 3.6 | 2.8 | 0.2 | 2.2 | 12.4 |
| | V | E | M | SF | F | ASH |
| Average | 93.0 | 2.4 | 2.5 | — | 2.1 | 8.8 |

LOWER KITTANNING COALS

SAMPLE NO: 85-C-34 Lower Kittanning

COMPANY: Unknown - near Jeffries School 3A

LOCATION: Glen Richey $7\frac{1}{2}$ ' quadrangle8,700' South $40^{\circ}55'$ 8,900' East $78^{\circ}25'$

| inches | V | E | M | SF | F | ASH |
|-----------------------------------|------|-----|-----|-----|-----|------------|
| 0 - 2 | 89.4 | 3.6 | 3.8 | — | 3.2 | 11.7 |
| 2 - $12\frac{1}{2}$ | 95.2 | 1.0 | 2.2 | 1.4 | 0.2 | 2.7 |
| $12\frac{1}{2}$ - $13\frac{1}{2}$ | | | | | | brown clay |
| $13\frac{1}{2}$ - $17\frac{1}{2}$ | 96.6 | 1.8 | 1.8 | — | — | 6.0 |
| $17\frac{1}{2}$ - 20 | 91.6 | 4.2 | 2.4 | — | 1.8 | 12.4 |
| | V | E | M | SF | F | ASH |
| Average | 94.4 | 1.9 | 2.3 | 0.7 | 0.7 | 5.8 |

SAMPLE NO: 85-C-35 Lower Kittanning

COMPANY: Wilkes Mine 2, 3A

LOCATION: Wallaceton $7\frac{1}{2}$ ' quadrangle7,800' North $40^{\circ}55'$ 2,700' West $78^{\circ}15'$

| inches | V | E | M | SF | F | ASH |
|-----------------------------------|------|-----|------|-----|------|-------|
| 0 - 1 | 85.2 | 2.8 | 6.2 | 0.8 | 5.0 | 12.3 |
| 1 - 3 | | | | | | |
| 3 - 14 | 89.8 | 3.6 | 3.0 | 2.2 | 1.4 | 4.5 |
| | | | | | | 3a |
| | | | | | | clay |
| 14 - $21\frac{1}{2}$ | 95.0 | 1.4 | 2.6 | — | 1.0 | 9.2 |
| $21\frac{1}{2}$ - 28 | | | | | | |
| 28 - $33\frac{1}{2}$ | 71.0 | 8.2 | 12.4 | 0.4 | 8.0 | 23.5 |
| $33\frac{1}{2}$ - 35 | 78.8 | 7.8 | 7.4 | 0.8 | 5.2 | 18.6 |
| 35 - 36 | | | | | | 2 |
| 36 - $38\frac{1}{2}$ | 86.6 | 2.6 | 4.4 | 0.2 | 6.2 | 14.7 |
| $38\frac{1}{2}$ - $41\frac{1}{2}$ | | | | | | |
| 41 $\frac{1}{2}$ - 47 | 85.6 | 2.8 | 2.2 | 3.8 | 5.6 | 10.7 |
| 47 - 48 | | | | | | |
| 48 - $50\frac{1}{2}$ | 85.0 | 1.2 | 1.8 | 2.0 | 10.0 | 10.7 |
| | V | E | M | SF | F | ASH |
| Average | 91.5 | 2.8 | 3.0 | 1.3 | 1.4 | 6.6 |
| Average | 80.5 | 4.7 | 6.1 | 1.7 | 7.0 | 16.0 |
| Average | 86.2 | 3.7 | 4.5 | 1.5 | 4.1 | 11.1 |
| | | | | | | total |

LOWER KITTANNING COALS

SAMPLE NO: 85-C-40 Lower Kittanning

COMPANY: 1 mile S.W. of Bigler 3

LOCATION: Wallacetton 7½' quadrangle
9,700' South 41°00'
2,400' East 78°20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0 - 4½ | 86.6 | 5.0 | 3.8 | 0.4 | 4.2 | 15.1 |
| 4½ - 10 | 90.8 | 5.0 | 3.4 | 0.4 | 0.4 | 6.1 |
| 10 - 20 | 87.2 | 5.6 | 2.2 | 2.6 | 2.4 | 5.4 |
| 20 - 22 | 86.4 | 3.6 | 4.0 | 2.4 | 3.6 | 17.0 |
| 22 - 28 | 91.2 | 3.6 | 3.2 | 0.4 | 1.6 | 8.2 |
| | V | E | M | SF | F | ASH |
| Average | 87.9 | 5.1 | 3.0 | 1.6 | 2.4 | 8.6 |
| Average | 91.2 | 3.6 | 3.2 | 0.4 | 1.6 | 8.2 |
| Average | 88.7 | 4.2 | 3.0 | 1.3 | 2.2 | 8.5 |

knife edge parting

3b

boney coal

3a

3b

3a

total

SAMPLE NO: 85-C-45 Lower Kittanning

COMPANY: Unknown 3A

LOCATION: Wallacetton 7½' quadrangle
13,000' South 41°00'
3,900' East 78°20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|-----|
| 0 - 5 | 93.2 | 3.2 | 2.0 | 0.4 | 1.2 | 4.4 |
| 5 - 10 | 94.2 | 3.8 | 0.6 | — | 1.4 | 2.6 |
| 10 - 14 | 84.6 | 3.4 | 4.4 | 0.6 | 7.0 | 3.7 |
| 14 - 20 | 91.6 | 3.0 | 3.6 | 0.2 | 1.6 | 4.4 |
| | V | E | M | SF | F | ASH |
| Average | 91.3 | 3.3 | 2.6 | 0.3 | 2.5 | 3.8 |

fusain and clay

LOWER KITTANNING COALS

SAMPLE NO: 85-C-46 Lower Kittanning

COMPANY: Moore Strip 2

LOCATION: Wallacetown 7½' quadrangle
1,500' North 40°55'
1,600' East 78°20'

| inches | V | E | M | SF | F | ASH |
|-----------|------|-----|-----|-----|-----|--------------------------------|
| 0 - 1½ | 88.4 | 6.2 | 3.4 | 1.6 | 0.4 | 20.2 |
| 1½ - 5½ | 86.8 | 6.4 | 5.0 | 1.8 | — | 13.2 |
| 5½ - 12 | 82.0 | 4.8 | 5.4 | 2.4 | 5.4 | 13.8 |
| 12 - 13 | — | — | — | — | — | pyritic |
| 13 - 17½ | 87.4 | 1.0 | 3.2 | 1.8 | 6.6 | 12.3 |
| 17½ - 18½ | — | — | — | — | — | thick fusain at top of parting |
| 18½ - 26 | 92.8 | 2.6 | 1.8 | 0.6 | 2.2 | 10.7 |
| | V | E | M | SF | F | ASH |
| Average | 87.6 | 3.7 | 3.7 | 1.6 | 3.4 | 12.8 |

SAMPLE NO: 85-C-47 Lower Kittanning

COMPANY: Moore 3A

LOCATION: Wallacetown 7½' quadrangle
1,500' North 40°55'
1,000' East 78°20'

| inches | V | E | M | SF | F | ASH |
|----------|------|-----|-----|-----|-----|------|
| 0 - 2 | 90.2 | 3.8 | 2.6 | — | 3.4 | 14.0 |
| 2 - 6 | 93.0 | 3.8 | 1.8 | 1.0 | 0.8 | 3.8 |
| 6 - 13 | 92.4 | 3.4 | 2.4 | 1.0 | 0.8 | 3.7 |
| 13 - 14 | — | — | — | — | — | — |
| 14 - 17½ | 93.6 | 3.2 | 1.0 | 1.8 | 0.4 | 8.2 |
| | V | E | M | SF | F | ASH |
| Average | 92.5 | 3.5 | 2.0 | 0.9 | 1.1 | 5.9 |

SAMPLE NO: 85-C-48 Lower Kittanning

COMPANY: Moore 4

LOCATION: Wallacetown 7½' quadrangle
1,900' North 40°55'
900' East 78°20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|----|-----|-----|
| 0 - 3 | 95.4 | 3.0 | 0.8 | — | 0.8 | 3.2 |
| 3 - 9 | 93.2 | 5.4 | 1.2 | — | 0.2 | 3.6 |
| | V | E | M | SF | F | ASH |
| Average | 93.9 | 4.6 | 1.1 | — | 0.4 | 3.5 |

LOWER KITTANNING COALS

SAMPLE NO: 85-C-51 Lower Kittanning 1
 COMPANY: Company ? - Henderson Clay operation
 LOCATION: Ramey $7\frac{1}{2}$ ' quadrangle
 14,000' North $40^{\circ}50'$
 3,200' East $78^{\circ}25'$

| inches | V | E | M | SF | F | ASH |
|-----------------------|------|-----|-----|-----|-----|------|
| 0 - 9 | 84.0 | 4.4 | 4.8 | 1.4 | 5.4 | 12.9 |
| 9 - 12 | 83.0 | 3.0 | 7.8 | 2.6 | 3.6 | 12.2 |
| 12 - 16 | 84.2 | 1.6 | 5.0 | 1.4 | 7.8 | 7.8 |
| 16 - 20 | 82.8 | 1.6 | 4.4 | 1.6 | 9.6 | 13.4 |
| 20 - 21 $\frac{1}{2}$ | | | | | | |
| 21 $\frac{1}{2}$ - 25 | 85.6 | 2.4 | 4.6 | 3.0 | 4.4 | 13.6 |
| | V | E | M | SF | F | ASH |
| Average | 83.8 | 2.9 | 5.4 | 1.9 | 6.0 | 12.1 |

SAMPLE NO: 85-C-55 Lower Kittanning 1
 COMPANY: Unknown
 LOCATION: Ramey $7\frac{1}{2}$ ' quadrangle
 9,500' North $40^{\circ}50'$
 4,000' East $78^{\circ}25'$

| inches | V | E | M | SF | F | ASH |
|-----------------------|------|-----|-----|-----|-----|------|
| 0 - 2 | | | | | | 29.4 |
| 2 - 6 | 83.6 | 4.8 | 3.8 | 4.2 | 3.6 | 6.8 |
| 6 - 10 $\frac{1}{2}$ | 92.8 | 1.6 | 2.8 | 1.4 | 1.4 | 5.9 |
| 10 $\frac{1}{2}$ - 18 | 87.8 | 2.2 | 4.4 | 2.0 | 3.6 | 5.4 |
| 18 - 21 | 85.8 | 1.6 | 3.2 | 1.2 | 8.2 | 7.2 |
| | V | E | M | SF | F | ASH |
| Average | 87.8 | 2.5 | 3.7 | 2.2 | 3.8 | 6.1 |

SAMPLE NO: 85-C-56 Lower Kittanning 2
 COMPANY: Unknown
 LOCATION: Ramey $7\frac{1}{2}$ ' quadrangle
 9,500' North $40^{\circ}50'$
 4,000' East $78^{\circ}25'$

| inches | V | E | M | SF | F | ASH |
|-----------------------|------|------|-----|-----|------|------|
| 0 - 1 | 70.6 | 10.2 | 7.8 | 2.0 | 9.4 | 22.6 |
| 1 - 3 | 89.8 | 4.4 | 2.6 | 1.2 | 2.0 | 15.9 |
| 3 - 7 | 75.0 | 3.8 | 8.8 | 2.2 | 10.2 | 8.5 |
| 7 - 9 | 90.6 | 2.2 | 1.8 | 0.8 | 4.6 | 9.4 |
| 9 - 14 | 89.2 | 3.2 | 4.8 | — | 2.8 | 9.9 |
| 14 - 17 $\frac{1}{2}$ | 90.2 | 3.0 | 2.6 | 1.8 | 2.4 | 12.7 |
| | V | E | M | SF | F | ASH |
| Average | 85.3 | 3.7 | 4.9 | 1.2 | 4.9 | 11.5 |

SAMPLE NO: 85-C-57 Lower Kittanning 3A
 COMPANY: Unknown
 LOCATION: Ramey $7\frac{1}{2}$ ' quadrangle
 9,500' North $40^{\circ}50'$
 4,000' East $78^{\circ}25'$

| inches | V | E | M | SF | F | ASH |
|-----------------------|------|-----|-----|-----|-----|------|
| 0 - 4 | 89.2 | 7.0 | 3.2 | — | 0.6 | 11.0 |
| 4 - 5 | 96.4 | 2.4 | 0.8 | — | 0.4 | 5.0 |
| 5 - 9 $\frac{1}{2}$ | 93.4 | 4.0 | 1.8 | 0.8 | — | 4.0 |
| 9 $\frac{1}{2}$ - 15 | 88.8 | 1.8 | 4.8 | 1.6 | 3.0 | 4.7 |
| 15 - 18 | 93.0 | 1.4 | 1.8 | 1.6 | 2.2 | 8.1 |
| 18 - 19 | | | | | | |
| 19 - 21 $\frac{1}{2}$ | 97.6 | 1.8 | 0.6 | — | — | 6.2 |
| | V | E | M | SF | F | ASH |
| Average | 91.9 | 3.3 | 2.6 | 0.9 | 1.3 | 6.5 |

SAMPLE NO: 85-C-59 Lower Kittanning 4
 COMPANY: Unknown
 LOCATION: Houtzdale $7\frac{1}{2}$ ' quadrangle
 12,300' North $40^{\circ}50'$
 300' East $78^{\circ}20'$

| inches | V | E | M | SF | F | ASH |
|---------------------|------|-----|-----|-----|-----|------|
| 0 - 1 $\frac{1}{2}$ | 93.0 | 0.4 | 3.0 | 0.2 | 3.4 | 11.1 |
| 1 $\frac{1}{2}$ - 5 | 95.2 | 3.0 | 1.6 | — | 0.2 | 4.3 |
| 5 - 7 | 91.4 | 3.0 | 2.4 | 0.4 | 2.8 | 5.0 |
| 7 - 11 | 98.4 | 1.2 | 0.4 | — | — | 8.5 |
| | V | E | M | SF | F | ASH |
| Average | 95.4 | 2.0 | 1.5 | 0.1 | 1.0 | 6.9 |

SAMPLE NO: 85-C-60 Lower Kittanning 3A
 COMPANY: Unknown
 LOCATION: Houtzdale $7\frac{1}{2}$ ' quadrangle
 12,300' North $40^{\circ}50'$
 100' East $78^{\circ}20'$

| inches | V | E | M | SF | F | ASH |
|-----------------------|------|-----|-----|-----|-----|------|
| 0 - 3 | 87.8 | 3.0 | 2.6 | 1.2 | 5.4 | 14.1 |
| 3 - 3 $\frac{1}{2}$ | | | | | | |
| 3 $\frac{1}{2}$ - 9 | 94.4 | 2.0 | 1.4 | 0.4 | 1.8 | 3.0 |
| | V | E | M | SF | F | ASH |
| 9 - 14 $\frac{1}{2}$ | 90.4 | 3.2 | 3.2 | 1.6 | 1.6 | 3.0 |
| 14 $\frac{1}{2}$ - 16 | 82.2 | 2.8 | 7.0 | 1.2 | 6.8 | 17.6 |
| 16 - 20 $\frac{1}{2}$ | 91.8 | 4.6 | 0.4 | 0.4 | 2.8 | 5.0 |
| 20 $\frac{1}{2}$ - 21 | | | | | | |
| 21 - 23 $\frac{1}{2}$ | 93.4 | 3.6 | 2.2 | 0.2 | 0.6 | 9.4 |
| | V | E | M | SF | F | ASH |
| Average | 91.1 | 3.2 | 2.3 | 0.8 | 2.6 | 6.6 |

carbonaceous c.
 knife edge clay
 clay

LOWER KITTANNING COALS

SAMPLE NO: 85-C-67 Lower Kittanning

COMPANY: Hansel

3A

LOCATION: Houtzdale 7½' quadrangle
12,800' North 40°50'
10,900' West 78°20'

| inches | V | E | M | SF | F | ASH |
|----------|-------|-----|-----|-----|-----|-------------------|
| 0 - 2½ | 93.6 | 3.2 | 2.6 | — | 0.6 | 5.2 |
| 2½ - 7 | 93.2 | 3.6 | 1.4 | — | 1.8 | 2.8 |
| 7 - 14 | 92.0 | 3.6 | 3.4 | — | 1.0 | 2.4 |
| 14 - 14½ | <hr/> | | | | | coaly shale |
| 14½ - 20 | 95.0 | 2.4 | 1.4 | 0.8 | 0.4 | 6.2 |
| 20 - 20½ | 90.8 | 3.0 | 2.6 | 0.6 | 3.0 | 12.2 |
| 20½ - 22 | <hr/> | | | | | carbonaceous clay |
| | V | E | M | SF | F | ASH |
| Average | 93.1 | 3.2 | 2.3 | 0.3 | 1.1 | 4.5 |

SAMPLE NO: 85-C-68 Lower Kittanning

4

COMPANY: Hansel

LOCATION: Houtzdale 7½' quadrangle
12,900' North 40°50'
10,400' West 78°20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|-----|
| 0 - 4 | 90.6 | 6.6 | 1.2 | 0.4 | 1.2 | 4.0 |
| 4 - 8 | 92.0 | 2.4 | 2.4 | 0.2 | 3.0 | 2.3 |
| 8 - 11½ | 95.8 | 3.0 | 0.6 | 0.4 | 0.2 | 3.0 |
| | V | E | M | SF | F | ASH |
| Average | 92.8 | 4.0 | 1.4 | 0.3 | 1.5 | 3.1 |

SAMPLE NO: 85-C-74 Lower Kittanning

5

COMPANY: Davis Trucking

LOCATION: Wallacetown 7½' Quadrangle
7,100' South 40° 55'
9,300' East 78° 20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-3 | 85.4 | 2.4 | 3.8 | 0.2 | 8.2 | 15.0 |
| 3-5 | 83.2 | 3.2 | 4.4 | 0.8 | 8.4 | 22.3 |
| 5-9 | 90.2 | 2.0 | 2.0 | 1.6 | 4.2 | 16.9 |
| | V | E | M | SF | F | ASH |
| Average | 87.0 | 2.4 | 3.1 | 1.0 | 6.5 | 17.5 |

LOWER KITTANNING COALS

SAMPLE NO: 85-C-69 Lower Kittanning

COMPANY: Hansel 5

LOCATION: Houtzdale 7½' quadrangle
12,500' North 40°50'
10,300' West 78°20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| | | | | | | |
| 0 - 4 | 91.0 | 1.2 | 2.2 | 4.6 | 1.0 | 10.3 |
| 4 - 8 | | | | | | |
| 8 - 14 | 89.6 | 1.4 | 3.2 | 0.8 | 5.0 | 14.0 |
| | V | E | M | SF | F | ASH |
| Average | 90.2 | 1.3 | 2.8 | 2.3 | 3.4 | 12.5 |

silty lenses with
coaly interbeds

SAMPLE NO: 85-C-72 Lower Kittanning

COMPANY: Davis Trucking Company 3A

LOCATION: Wallacetown 7½' quadrangle
7,100' South 40°55'
9,300' East 78°20'

| inches | V | E | M | SF | F | ASH |
|--------------|------|-----|-----|-----|-----|-----|
| | | | | | | |
| 0 - 1 | | | | | | |
| 1 - 3 | 91.2 | 4.0 | 1.8 | 1.0 | 2.0 | 6.5 |
| 3 - 6 | 88.4 | 4.6 | 2.2 | 0.8 | 4.0 | 6.3 |
| 6 - 13 | 90.6 | 2.8 | 3.0 | 1.8 | 1.8 | 2.9 |
| 13 - 14½ | 90.4 | 3.4 | 1.6 | 3.2 | 1.4 | 8.1 |
| 14½ - 20 | 92.0 | 4.8 | 1.2 | 0.8 | 1.2 | 7.6 |
| 20 - 23 | 93.4 | 3.0 | 1.4 | — | 2.2 | 6.6 |
| | V | E | M | SF | F | ASH |
| Average | 91.0 | 3.7 | 2.1 | 1.2 | 2.0 | 5.6 |
| 0 - 13 | 90.2 | 3.4 | 2.6 | 1.4 | 2.4 | 4.4 |
| lower 8½" | 92.2 | 4.1 | 1.3 | 0.8 | 1.5 | 7.4 |

clay
clay
pyritic clay

SAMPLE NO: 85-C-73 Lower Kittanning

COMPANY: Davis Trucking Company 4

LOCATION: Wallacetown 7½' quadrangle
7,100' South 40°55'
9,300' East 78°20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| | | | | | | |
| 0 - 1½ | 93.8 | 4.6 | 1.4 | — | 0.2 | 12.4 |
| 1½ - 5½ | 93.4 | 4.2 | 2.0 | — | 0.4 | 3.8 |
| 5½ - 8 | 89.8 | 7.2 | 2.6 | 0.2 | 0.2 | 3.5 |
| 8 - 12½ | 97.6 | 1.8 | 0.6 | — | — | 5.5 |
| | V | E | M | SF | F | ASH |
| Average | 94.2 | 4.0 | 1.5 | 0.1 | 0.2 | 5.4 |

LOWER KITTANNING COALS

SAMPLE NO: 85-C-75 Lower Kittanning
 COMPANY: Du Shan Mine 3
 LOCATION: Houtzdale 7½' Quadrangle
 4,600' N 40° 50'
 6,300' W 78° 15'

| inches | V | E | M | SF | F | ASH | |
|---------|------|-----|-----|-----|-----|------|-----|
| 0-6 | 84.2 | 8.8 | 4.8 | 0.6 | 1.6 | 13.8 | 3b? |
| 6-15 | 90.0 | 3.2 | 3.0 | 1.6 | 2.2 | 4.5 | |
| 15-19 | 92.2 | 3.0 | 3.0 | 1.0 | 0.8 | 4.7 | |
| 19-24½ | 92.6 | 1.6 | 1.8 | 1.8 | 2.2 | 5.2 | 3a |
| 24½-26 | | | | | | | |
| 26-31 | 95.6 | 0.8 | 0.6 | 0.8 | 2.2 | 10.8 | |
| 31-34 | 90.6 | 3.4 | 2.4 | — | 3.6 | 8.2 | |
| Av 3a | 92.0 | 2.4 | 2.2 | 1.2 | 2.2 | 6.3 | |
| | V | E | M | SF | F | ASH | |
| Average | 90.6 | 3.6 | 2.7 | 1.1 | 2.0 | 7.7 | |

SAMPLE NO: 85-C-80 Lower Kittanning
 COMPANY: Unknown 1
 LOCATION: Houtzdale 7½' Quadrangle
 8,800' N 40° 45'
 7,400' W 78° 20'

| inches | V | E | M | SF | F | ASH | |
|---------|-------------------|-----|-----|-----|-----|------|----------------|
| 0-6 | 89.4 | 2.4 | 4.6 | 0.8 | 2.8 | 5.0 | |
| 6-13 | 89.8 | 1.2 | 3.4 | 0.4 | 5.2 | 4.7 | |
| 13½-15½ | 92.2 | 3.6 | 2.6 | 0.8 | 0.8 | 12.0 | Fusain parting |
| 15½-20½ | Claystone Parting | | | | | | |
| 20½-25½ | 81.4 | 5.2 | 6.6 | 1.6 | 5.2 | 16.0 | |
| 25½-30½ | 82.0 | 3.8 | 5.6 | 2.6 | 6.0 | 10.2 | Boney coal |
| 31-37 | 90.4 | 0.6 | 2.0 | 1.4 | 5.6 | 9.0 | |
| 37½-43½ | 86.6 | 2.0 | 4.0 | 2.2 | 5.2 | 16.5 | |
| 43½-48½ | Carb Shale | | | | | | Shale |
| | V | E | M | SF | F | ASH | |
| Average | 87.2 | 2.4 | 4.2 | 1.4 | 4.8 | 10.0 | |

LOWER KITTANNING COALS

SAMPLE NO: 85-C-81 Lower Kittanning
 COMPANY: Unknown 3A, 3B
 LOCATION: Houtzdale $7\frac{1}{2}$ ' Quadrangle
 9,100' N $40^{\circ} 45'$
 7,600' W $78^{\circ} 20'$

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-4 | 81.6 | 8.6 | 4.6 | — | 5.2 | 8.4 |
| 4-14 | 91.8 | 3.4 | 1.8 | 0.2 | 2.8 | 5.2 |
| 14-18 | 91.6 | 2.0 | 2.4 | — | 4.0 | 13.0 |
| Average | 89.5 | 4.2 | 2.6 | 0.1 | 3.6 | 7.6 |

3B
pyritic
3A

SAMPLE NO: 85-C-82 Lower Kittanning
 COMPANY: Unknown 3B
 LOCATION: Houtzdale $7\frac{1}{2}$ ' Quadrangle
 9,200' N $40^{\circ} 45'$
 7,800' W $78^{\circ} 20'$

| inches | V | E | M | SF | F | ASH |
|-----------------------------------|------|-----|-----|-----|-----|-----|
| 0-4 $\frac{1}{2}$ | 84.8 | 3.0 | 5.4 | — | 6.8 | 5.5 |
| 4 $\frac{1}{2}$ -10 $\frac{1}{2}$ | 86.2 | 5.2 | 4.0 | 1.6 | 3.0 | 4.2 |
| 10 $\frac{1}{2}$ -14 | 94.8 | 3.4 | 0.8 | — | 1.0 | 4.0 |
| Average | 87.9 | 4.0 | 3.7 | 0.7 | 3.7 | 4.6 |

pyritic

SAMPLE NO: 85-C-91 Lower Kittanning
 COMPANY: Unknown 3A
 LOCATION: Glen Richey $7\frac{1}{2}$ ' Quadrangle
 6,100' N $40^{\circ} 55'$
 3,800' W $78^{\circ} 25'$

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-4 | 91.8 | 4.0 | 3.8 | 0.2 | 0.2 | 13.4 |
| 4-15 | 95.4 | 1.8 | 2.0 | — | 0.8 | 3.7 |
| 15-17 | | | | | | |
| 17-27 | 92.6 | 1.8 | 2.4 | 1.0 | 2.2 | 11.2 |
| Average | 94.0 | 2.2 | 2.5 | 0.3 | 1.0 | 7.5 |

SAMPLE NO: 95-C-1 Lower Kittanning
 COMPANY: Unknown 3B, 3A

LOCATION: Philipsburg $\frac{1}{2}$ ' quadrangle
 14,300' N. $40^{\circ} 55'$
 2,200' E. $78^{\circ} 15'$

| inches | V | E | M | SF | F | ASH |
|--------------------------------------|------|-----|-----|-----|-----|------|
| 0-4" | 90.2 | 3.2 | 3.8 | 2.2 | 0.6 | 7.5 |
| 4-7" | 84.2 | 3.6 | 3.4 | 2.4 | 6.4 | 4.7 |
| 7-13" | 89.4 | 4.6 | 4.0 | 0.4 | 1.6 | 4.0 |
| 13-19" | 90.8 | 2.8 | 3.2 | 1.0 | 2.2 | 4.5 |
| 19-23 $\frac{1}{2}$ " | 94.4 | 2.2 | 1.0 | 0.6 | 1.8 | 9.9 |
| 23 $\frac{1}{2}$ -25 $\frac{1}{2}$ " | 95.4 | 3.4 | 0.2 | 0.8 | 0.2 | 22.0 |
| Average | 90.6 | 3.3 | 2.9 | 1.1 | 2.1 | 7.2 |

3B

3A

CLARION COALS

SAMPLE NO: 85-C-6

Clarion 2

COMPANY: General Refractories
LOCATION: Wallaceton 7½ Quadrangle
7,100' North 40° 55'
8,200' East 78° 20'

| inches | V | E | M | SF | F | ASH |
|--------|---|---|---|----|---|-----|
| 0-18 | | | | | | |
| | V | E | M | SF | F | ASH |

Coal 18" thick

SAMPLE NO: 85-C-10

Clarion 1

COMPANY: unknown
LOCATION: Wallacetown $7\frac{1}{2}$ Quadrangle
7,200' South $41^{\circ} 00'$
7,500' East $78^{\circ} 20'$

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|------|------|
| 0-7 | 84.2 | 4.4 | 4.2 | 0.6 | 6.6 | 5.0 |
| 7-11 | 89.0 | 1.2 | 6.0 | 1.0 | 1.8 | 4.2 |
| 11-13 | 72.8 | 2.6 | 6.8 | 0.4 | 17.4 | 5.3 |
| 13-17½ | 91.6 | 4.2 | 3.4 | — | 0.8 | 4.4 |
| 17½-20 | 73.8 | 2.0 | 8.8 | 6.8 | 8.6 | 14.2 |
| | V | E | M | SF | F | ASH |
| Average | 84.4 | 3.3 | 5.3 | 1.3 | 5.7 | 5.9 |

SAMPLE NO: 85-C-26

Clarion 2

COMPANY: Crop - Haupt Heirs Well #1
LOCATION: Wallacetown 7½ Quadrangle
8,300' South 41° 00'
7,700' West 78° 20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 0-3 | 90.0 | 5.2 | 4.4 | — | 0.4 | 4.1 |
| 3-9 | 84.2 | 6.8 | 6.2 | 0.6 | 2.0 | 9.6 |
| 9-15 | — | — | — | — | — | 30.4 |
| 15-19 | 89.6 | 2.2 | 5.6 | — | 2.6 | 11.9 |
| 19-20 | — | — | — | — | — | — |
| 20-26 | 82.8 | 1.8 | 7.6 | — | 7.8 | 24.8 |
| | V | E | M | SF | F | ASH |
| Average | 85.8 | 4.0 | 6.2 | 0.3 | 3.7 | 14.0 |

Shaly coal parting

SAMPLE NO: 85-C-30

Clarion 2

COMPANY: unknown - near Kellytown
LOCATION: Glen Richey 7 $\frac{1}{2}$ Quadrangle
11,100' South 40° 55'
9,700' East 78° 30'

| inches | V | E | M | SF | F | ASH |
|---------|------|------|------|-----|-----|------|
| 0-4 | 87.2 | 4.8 | 4.2 | 0.8 | 3.0 | 9.5 |
| 4-9 | 82.8 | 3.2 | 5.6 | 2.2 | 6.4 | 9.2 |
| 9-16 | 71.6 | 10.0 | 11.6 | 2.2 | 4.6 | 18.9 |
| 16-20 | 86.4 | 1.4 | 6.4 | 1.2 | 4.6 | 10.0 |
| 20-25 | 87.0 | 3.2 | 4.0 | 2.2 | 3.6 | 16.3 |
| 25-27 | | | | | | 31.4 |
| | V | E | M | SF | F | ASH |
| Average | 81.7 | 5.1 | 6.9 | 1.8 | 4.5 | 13.5 |

CLARION COALS

SAMPLE NO: 85-C-31 Clarion 3
 COMPANY: Unknown near Kellytown
 LOCATION: Glen Richey 7½ quadrangle

| | V | E | M | SF | F | ASH |
|------------|---|---|----|----|-----|------|
| 0-9" | | | | | | |
| Boney coal | | | | | | |
| V | E | M | SF | F | ASH | |
| Average | | | | | | 39.7 |

SAMPLE NO: 85-C-49 Clarion 1

COMPANY: unknown
 LOCATION: Wallacetown 7½ Quadrangle
 7,900' South 41° 00'
 7,400' West 78° 15'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|------|------|------|
| 0-4 | 94.8 | 2.8 | 2.4 | — | — | 4.2 |
| 4-7 | 93.2 | 2.4 | 1.8 | 0.2 | 2.4 | 4.9 |
| 7-13 | 86.2 | 2.6 | 4.8 | 0.4 | 6.0 | 5.0 |
| 13-16 | 58.4 | 0.8 | 9.8 | 10.4 | 20.6 | 16.2 |
| V | E | M | SF | F | ASH | |
| Average | 84.1 | 2.3 | 4.7 | 2.2 | 6.7 | 6.9 |

Fusain and clay

SAMPLE NO: 85-C-41 Clarion 1

COMPANY: unknown
 LOCATION: Wallacetown 7½ Quadrangle
 10,200' South 41° 00'
 2,600' East 78° 20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|-----|
| 0-4 | 98.2 | 6.0 | 2.0 | 1.2 | 1.6 | 7.9 |
| 4-10 | 93.4 | 2.6 | 0.6 | 0.4 | 3.0 | 4.5 |
| 10-17 | 89.0 | 4.0 | 2.2 | 0.8 | 4.0 | 4.4 |
| 17-24 | 85.6 | 2.4 | 3.0 | — | 9.0 | 4.6 |
| V | E | M | SF | F | ASH | |
| Average | 89.2 | 3.5 | 2.0 | 0.5 | 4.8 | 5.1 |

SAMPLE NO: 85-C-79 Clarion 1,2,& 3

COMPANY: Elliot
 LOCATION: Houtzdale 7½ Quadrangle
 7,800' South 40° 50'
 11,400' East 78° 20'

| inches | V | E | M | SF | F | ASH |
|--------|------|-----|-----|-----|-----|-----|
| 0-10 | 77.0 | 7.0 | 8.4 | 3.2 | 4.4 | 8.3 |
| 10-11 | | | | | | |
| 11-20 | 82.6 | 2.4 | 5.6 | 1.0 | 8.4 | 6.6 |
| 20-32 | 83.0 | 3.0 | 5.4 | 1.2 | 7.4 | 9.4 |

Carbonaceous shale

SAMPLE NO: 85-C-44 Clarion 1

COMPANY: Thompson
 LOCATION: Wallacetown 7½ Quadrangle
 10,900' North 40° 55'
 9,800' West 70° 15'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|-----|
| 0-4 | 87.2 | 5.4 | 4.0 | 1.8 | 1.6 | 8.5 |
| 4-8 | 93.4 | 2.0 | 2.0 | 1.2 | 1.4 | 5.2 |
| 8-12 | 85.8 | 2.4 | 4.8 | 0.4 | 6.6 | 5.7 |
| V | E | M | SF | F | ASH | |
| Average | 88.8 | 3.3 | 3.6 | 1.1 | 3.2 | 6.5 |

Clay

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|-----|-----|------|
| 32½-48½ | 90.0 | 1.8 | 4.6 | — | 3.6 | 12.8 |
| 48½-57½ | 88.0 | 2.4 | 4.0 | 2.4 | 3.2 | 10.2 |
| 57½-58½ | | | | | | |
| 58½-63½ | 95 | 2.2 | 1.4 | — | 0.6 | 8.1 |
| V | E | M | SF | F | ASH | |
| Average | 85.5 | 3.1 | 5.2 | 1.3 | 4.9 | 9.7 |

Pyritic fauna

MERCER COALS

SAMPLE NO: 85-C-5 Mercer - upper bed

COMPANY: General Refractories
 LOCATION: Wallacetown 7½ Quadrangle
 6,900' North 40° 55'
 8,100' East 78° 20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|------|-----|------|------------|
| | V | E | M | SF | F | ASH |
| 0-8 | 77.5 | 2.2 | 4.9 | 3.6 | 11.8 | 10.9 |
| 8-10 | | | | | | Shaly coal |
| 10-20 | 75.0 | 3.4 | 14.0 | 2.6 | 5.0 | 11.0 |
| Average | 76.1 | 2.9 | 10.0 | 3.0 | 8.0 | 11.0 |

SAMPLE NO: 85-C-36 Mercer - lower bed

COMPANY: Harbison Walker
 LOCATION: Wallacetown 7½ Quadrangle
 5,900' South 40° 55'
 4,000' West 78° 20'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|-----|------|------|--|
| | V | E | M | SF | F | ASH |
| 0-5 | 91.2 | 3.2 | 1.2 | — | 4.4 | 14.3 |
| 5-11 | | | | | | Gray clay shale with plant fossils |
| 11-11¾ | 97.4 | 2.0 | 0.4 | — | 0.2 | 24.2 |
| 11¾-15 | | | | | | Carbonaceous shale with Canneloid triletes |
| 15-17 | 82.2 | 2.8 | 8.8 | 10.2 | 7.2 | 17.4 |
| 17½-24 | 71.0 | 2.8 | 8.8 | 10.2 | 7.2 | 17.4 |
| 24-25 | | | | | | Pyrite, fusain parting |
| 25-27 | 76.4 | 1.2 | 4.2 | 3.4 | 14.8 | 23.4 |
| Average | 80.3 | 2.7 | 5.1 | 4.8 | 7.1 | 16.5 |

SAMPLE NO: 85-C-50 Mercer - lower bed

COMPANY: unknown
 LOCATION: Glen Richey 7½ Quadrangle
 10,200' South 40° 55'
 2,400' West 78° 25'

| inches | V | E | M | SF | F | ASH |
|---------|------|-----|------|-----|-----|------|
| | V | E | M | SF | F | ASH |
| 0-2 | 87.0 | 2.4 | 5.0 | 1.8 | 3.8 | 14.5 |
| 2-5 | 74.6 | 4.6 | 15.4 | 2.6 | 2.8 | 12.0 |
| 5-9 | 78.6 | 4.6 | 9.0 | 4.4 | 3.4 | 8.9 |
| 9-14 | 80.2 | 4.6 | 6.2 | 1.4 | 7.6 | 10.8 |
| Average | 79.5 | 4.3 | 8.8 | 2.6 | 4.8 | 11.0 |





WERT
BOOKBINDING

MIDDLETON, PA

OCTOBER 1973

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